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"The Tactical Operations of the Future (Including Questions of Supply and Transport of Ammunition) as Affected by the Introduction of Magazine Rifles, Machine and Quick-Firing Guns, and Smokeless Powder."

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MILITARY PRIZE ESSAY.

"THE TACTICAL OPERATIONS OF THE FUTURE (INCLUDING QUESTIONS OF SUPPLY AND TRANSPORT OF AMMUNITION) AS AFFECTED BY THE INTRODUCTION OF MAGAZINE RIFLES, MACHINE AND QUICK-FIRING GUNS, AND SMOKELESS POWDER."[1]

By Captain G. E. Benson, R.A.

"Nullius in Verba."

CONTENTS.

[1] The Essay has exceeded the estimated length, but in consequence of the importance of the subject, it has not been thought desirable to shorten it.—Ed.

SMOKELESS POWDER.

In considering the effect of the use of smokeless powder on the tactics of the future, there is no war experience to guide us, and, beyond the effects noted at the manœuvres of some European armies, there is little to assist our researches except the imagination. The impressions of those present at the Continental manœuvres are therefore extremely important, especially as it seems more easy to realize the effect of smokeless powder in war from mere manœuvres in peace than that to be produced by magazine rifles and machine-guns, the reason being that in the latter case, the highly strung state of men's nerves in battle and its effect on shooting is a factor impossible to take a correct estimate of when no bullets are flying about. We therefore cannot do better than quote a few impressions of those who took part in, or were present at, the German and French manœuvres of 1889 and 1890.

Impressions gained at recent Manœuvres.—Of the German manœuvres of 1889, when two corps opposed each other, the one with

black and the other with smokeless powder, a German officer[1] writes as follows: "The powder being nearly free from smoke, allowed the marksmen to take better aim than was possible with the old powder, especially in damp atmosphere without wind, when the smoke lay on the ground and formed almost an opaque wall between the marksman and his object. A better aim, easier judging distance, quicker firing on sudden appearance of large objects, as for instance, supports, columns, advancing batteries, cavalry, &c. . . . . all this was facilitated by the use of smokeless powder."

On the same subject Mr. G. Saunders[2] says:—

"Summing up the results of the day as affected by the use of smokeless powder, it exercised a most demoralizing and bewildering effect upon the troops exposed to infantry fire. Further (1.) The enemy (using black powder) experienced extraordinary difficulty in determining (*a*) the distance, (*b*) the direction whence the fire came. (2.) The smokeless powder gave the Army Corps which used it a greatly increased certainty of aim arising from the absence of smoke from their own fire. This was especially asserted in the case of the artillery. It was freely stated that on this account the artillery were able to fire twice as many rounds as in the same period with the old powder. (3.) When the infantry was firing, brown smoke was faintly visible from the flanks; facing their fire, no smoke or next to none could be perceived. On the 20th and 21st September artillery Officers were freely declaring that the new powder weighed half as much as the old, thus enabling double the quantity (of blank) to be transported."

The military correspondent of the "Times" (September 16th) at the French manœuvres of 1890 confirms what was observed by Mr. Saunders as to the invisibility of smoke of infantry fire from the front at distances beyond 50 yards. A German officer writing in the "Militär Wochenblatt"[3] says: "Our regulations, both for fire and drill, have now laid it down that all considerations as regards cover must be subordinated to fire effect. So that now it can no longer be urged, in opposition to smokeless powder, that it fails in giving good cover to the firing line in the way the smoke of the black powder did. In fire action now, in accordance with the principle quoted, the men must think how best they can get the fullest fire effect and not how they may most securely find shelter; . . . . . if one side can command the services of smokeless powder it will see better, aim better, carry out its fire discipline more perfectly, and, finally, produce a greater fire effect."

General Considerations.—Hence the superiority of smokeless powder, which will cause all nations to adopt it. The arming of troops with magazine rifles and the introduction of machine-guns makes its adoption still more necessary; for how are men to fire rapidly a magazine full of cartridges with anything approaching accuracy when

[1] Major Rogalla von Bieberstein, "Colburn's U.S. Mag.," February, 1890.

[2] "The Last German Manœuvres." Lecture at R.U.S. Institution, 13th June, 1890.—("Morning Post," 16th June.)

[3] "R.A.I. Journal," November, 1889. (Translated by Captain May.)

at the first shot their front is obscured with smoke which increases at each discharge? What sportsman, shooting with black powder, has not experienced the mortification of being unable to put in his second barrel owing to the smoke caused by the first?

On the other hand, the curtain of smoke gave a certain amount of confidence to the firing line, which apparently felt a sort of security (of the ostrich description) behind it, and the smoke hid some ghastly sights from the men's view which will now be more visible. The moral and invigorating effect on the soldier of firing off his weapon and producing a cloud of smoke was considerable, and many are the instances quoted in recent wars of men shooting to keep up their courage. It seems likely the noise and smoke had a great deal to do with this. The noise (slightly decreased) remains, but the smoke has gone, and the opposing lines will be able at decisive ranges to see each other face to face.

Smokeless Powder not Noiseless.—For some time there existed a general idea that smokeless powder would be more or less noiseless, and still further complicate the problem of its effect on the tactics of the future. But those who have heard it know that this is an error, and we may take Sir F. Abel's[1] word for it, that such a powder is not likely to trouble us during the present generation.

Having, so to speak, prepared the way for thinking out the effect of smokeless powder, the various operations of war as affected by this new element will now be examined.

Effects of Smoke.—The effect of smoke is that it hides everything, and once in the thick of the fight practically nothing is seen. Remove the smoke, and the enemy is exposed to view if within decisive range; if not, then the ground where he is is likely to be seen.

Combatants may be divided into two categories—

(1.) Bodies of skirmishers, batteries in action, and all units in the act of firing are inconvenienced by their own smoke.

(2.) Bodies such as columns of supports, reserves, batteries in motion and cavalry, and all troops which are not firing benefit by smoke, but in the way of cover only.

But it is acknowledged now that all considerations of cover must yield to those which favour efficacy of fire. In short, as Captain Moch[2] puts it: "To see is of the first importance in battle, and, after that, not to be seen." If unable to see, not only are men unable to fire properly, but owing to the uncertainties consequent on not being able to see, they are much more liable to sudden panic. Like men in the dark they conjure up dangers which do not exist.

Infantry v. *Infantry.*

However perfect may be the fire discipline of infantry, its fire effect depends more on each individual soldier than is the case with artillery. This must always remain true, since artillery Officers

[1] "Engineering," 7th February, 1890.
[2] "La poudre sans fumée et la tactique," "Revue d'Artillerie," tome xxxv.

have far fewer units of fire to deal with, and have, as a rule, to exercise their control at a much greater distance from the enemy. As infantry advanced to the attack, the position of the enemy was disclosed to it by the smoke of his fire; but when the attackers opened fire, very soon the enemy's position was hidden from them by smoke. The enemy was thus first of all seen and then not seen. In the future, the reverse will be the case. Attacking infantry has to feel its way, and, perhaps, on arriving within 400 or 500 yards, it will see the enemy face to face. When this takes place, the side which can develop the greatest and most efficient fire will win the day. Over open ground, the attacking line can advance no further until the fire of the stationary or defending troops is almost subdued, and the intensity of fire necessary to produce that effect is so great that before the attackers advance the defenders will most probably have retired. The only case where that seems unlikely is, when the ground in rear of the defenders is not only swept by fire but is in full view of the attackers; as, for instance, when their only line of retreat lies up a steep slope in rear. In this case nothing will remain for the defenders, when completely cowed and demoralized, but to surrender. There will no longer be a screen of smoke, under cover of which the retirement can be effected unseen. On the other hand, the supports and reserves of the attackers being in future unhidden by smoke, the task of the attackers is much more difficult, and they will have to deploy earlier and make more use of the ground as cover. It would seem, therefore, that the frontal attack of infantry by infantry, even in much superior force, over open ground, is rendered much more difficult than formerly (during daylight) by the introduction of smokeless powder, the quality of the troops on both sides being equal.

Effects of Terrain.—In broken or enclosed country where much cover is available the case is different. Here advancing infantry can be concealed, and its presence even is no longer betrayed by smoke. The attackers may thus push forward superior numbers, and, unless considerable physical obstacles intervene, they have great chances of success. In such ground the attack and defence are placed on more even footing, and the absence of smoke conceals the strength of the attack as well as of the defence. Thus, victory will belong to that side which is strongest, can shoot best, and in which the control and fire discipline is the most perfect. Probably many cases will arise where friendly troops are mistaken for those of the enemy, for often the direction of the puffs of smoke shooting out from the rifles used to be the only guide for the moment as to whether they proceeded from friends or foes. For the same reason, local flank attacks will probably become more startling in their results owing to there being nothing to indicate whence the sudden shower of bullets proceeded.

Effect on Fire Discipline.—As regards fire discipline and control of men, the task of the commander of a unit will be facilitated by the absence of smoke, for (1) no longer blinded by smoke at decisive ranges, he will see better where to direct his aim; (2) he will see the whole of his unit, and consequently can hold the men better in hand;

(3) he will see the neighbouring units, and the better conform to their movements; (4) if killed he will be seen to fall, and the second in command can at once take his place. In these particulars the advantages pertain equally to the attack and defence.

Artillery v. *Artillery.*

The smoke caused by artillery fire being so much thicker than that of infantry, it would appear that smokeless powder will benefit the former arm to a proportionately greater extent. There are also no supports and reserves in the case of artillery to hide from view by smoke, the limbers and wagons being generally concealed by the ground.

Effects of Smoke.—The effects of smoke on artillery may be classed as follows:—

(1.) Smoke interferes with the laying, and frequent stoppages of fire have to take place to allow it to clear away.

(2.) Smoke discloses the position of every gun to the enemy, and therefore assists his accuracy of fire.

(3.) Smoke hides the immediate front of the line of guns, and may thus assist hostile skirmishers to creep up unseen.

On the other hand, (4) it hides movements from the enemy; and—

(5.) It makes his observation of fire in the case of long shells more difficult, for the bursts become confused with and lost in the smoke of the guns.

Nos. (4) and (5) are evidently not of such importance as the rest, for, in these days of long ranges, the movements of batteries on the battlefield are not so frequent, and the difficulty of observing bursts short and over is probably greater when the guns are judiciously placed and no smoke betrays their position.

Effect of Absence of Smoke.—The absence of smoke, however, will probably cause a former favourite manœuvre of artillery to be discontinued.

Sometimes, under an accurate hostile artillery fire, batteries advanced 100 yards or so under cover of the veil of smoke, and came again into action without attracting attention, thus causing the enemy to continue his fire at the original range. This will no longer be possible.

With a mass of guns in action, the smoke is so thick, particularly on damp still days, that it is a most difficult matter to lay the gun, much less to observe the fire. Hence, effectual concentration of fire must be very difficult to carry out. The absence of smoke, therefore, improves fire control and accuracy when laying on defined objects. It makes it possible to fire much more rapidly, as stated above (p. 397) by German Officers, on account of no check in the fire being necessary. It makes it very easy to mask batteries behind bushes or carefully placed epaulments, and thus gives a much harder task to the enemy's guns. A "Times"[1] telegram from the

[1] "Times," 26th August, 1890.

scene of the Italian manœuvres this year states that batteries remained in action for half an hour without being seen. On low ground this may often happen, but generally the crest of a ridge will partially define their position. The "Times" correspondent at the French manœuvres near Cambrai[1] says, "that at 2,500 yards a specially brilliant flash was observable with the naked eye, but no smoke. With a good glass, however, a puff of smoke, which almost immediately disappeared, was discernible." Later[2] on, however, he corrects this by saying that this puff was dust and not smoke. Hence dusty ground is a disadvantage.

The front of a line of guns will now be more secure, as skirmishers advancing over open ground will easily be seen. Prince Kraft[3] tells us how, at Königgratz, when the artillery were trying to beat each other down, the Austrian gunners did not notice the Prussian skirmishers followed by close columns, advancing against their front through the corn across an open valley. The result was that most of the guns were captured. This is not so likely to happen in future, however absorbed the gunners may be in their fire, so long as the ground in front is fairly open.

By reason of the smokeless powder cartridge being little more than half the weight of the old cartridge there is a saving of about 1½ lb. to 2 lbs. per round in the 12-pr., which means that nearly 10 per cent. more rounds can be carried, unless this saving of weight be used to provide brass cartridge cases.

It is probable also that the absence of smoke may, where the ground admits (as on a frontal slope) and where great concentration of fire is desirable, enable two tiers of artillery fire to be brought to bear, the more forward batteries being of course out of range of prematures from those in rear. As regards supporting an infantry attack, the gunners will be better able to see their own infantry advancing, and will not run the risk of keeping up the covering fire too long and killing their own friends.

The result of all this will be that it will become of great importance to pick out men with good vision, who, with the assistance of field glasses, telescopes, and other aids to sight, may be able to make out the position of the enemy's batteries, and observe the bursts of shell with reference to them. As his guns will present no such defined objects to lay on as formerly existed in the puffs of smoke, the flashes being more deceptive than smoke, points such as trees, houses, or smaller objects, will have to be chosen for regulating the fire by, when once their relative position to the hostile guns is made out. Thus, layers, no longer tempted to lay on the smoke, will be more in the hands of the commander of the battery, and will look to him to name the object to fire at. The difficulty the latter will experience in pointing out the object will, however, be increased, and either he will have to lay the first gun himself and cause the subalterns to look over the sights so as to fix the object in their minds,

[1] "Times," 18th September, 1890.
[2] "Times," 22nd September.
[3] "7th Letter on Cavalry."

or some sort of indicator may be used which all Nos. 1 can look over before laying their gun for the first time. Batteries will therefore not open fire in such a hurry as formerly, and very much will depend on the first shot being well laid. The most dangerous moment for artillery is when it comes into action in full view of an enemy already in position. The side which sees the other first will have gained a great advantage, as it can now often open fire without accurately disclosing its position. Therefore it is most probable that, except in urgent cases, guns will be brought up and unlimbered under cover, and then run up into position for the last 20 or 30 yards by hand. Guns peering over a crest are not likely to be noticed unless range-takers and battery commanders parade about on horseback in the open beforehand. Therefore their horses must be left under cover. The moral effect of the resulting suddenness in opening fire should be very great under such circumstances. These views are supported also by Captain von der Goltz[1] and by Captain Moch.[2]

If the ground permits of it the ranges at which fire will be opened will increase; for though it is to the interest of the assailant to get his artillery up to decisive range as soon as possible, yet the defender will prevent that, if he can, by opening fire immediately he sees the advancing enemy. The assailant, not seeing how far the enemy is away, will feel bound to take up the challenge till more definite knowledge of his position is obtained. This at least will be the case with the advanced guard artillery, though the reinforcing guns might at once advance to a closer range. The difficulty of regulating distant fire, with no puffs of smoke to guide the commanders of batteries, cannot but lead to considerable and increased expenditure of ammunition before the true range is found, in spite of all improvements in sights and range-finders. Commanding positions for guns will be sought after more than ever, in spite of the resulting plunging fire, for from such positions alone will it be possible to observe accurately the position of the enemy's guns, and, consequently, the relative burst of the shell. Batteries without such command may have observers stationed on trees or the tops of houses, where such exist; but at present balloons would appear to be too complicated and bulky for that purpose with a field army.

Smokeless powder may also enable guns to remain in action at closer intervals, since the laying of one gun is no longer impeded by the smoke of its neighbour. Hence a larger number may be brought into action in a given space.

Laying by means of pickets and clinometers from reverse slopes is sometimes advocated as a means of escaping loss. The disadvantage of smoke is here felt to a less extent; but for an assailant such a method can never succeed, for there would be great danger of firing into one's own advancing infantry as they approach the enemy—to say nothing of the inferior shooting. A very weak defensive force might, however, resort to it.

In general the influence of the formation of ground will be in-

[1] "Revue d'Artillerie," June, 1890.
[2] "Revue d'Artillerie," January, 1890.

creased, for folds of the ground, woods, hedgerows, &c., will alone have to be relied on for concealing movements. Should these not exist in an enemy's position, his reserves moving up either in attack or defence will be subject to cannonade more than ever. It therefore becomes an absolute necessity to silence the opposing guns before taking the offensive.

Shields for guns have been powerfully advocated as tending to diminish losses, but it would appear that they might offer a desirable target to an enemy, and it is only during the laying of the gun that the gunners would benefit by them. Besides, they offer no protection to limbers and teams.

Artillery v. *Infantry.*

Artillery may have opportunities of surprising infantry columns at long range in the future as in the past, and the fact of not seeing whence the shells come will add to the effect on the nerves of the infantry, and cause them to deploy sooner than might otherwise be the case. On the other hand artillery have more to fear from the fire of skirmishers in cramped country where they can creep up within range. The greater range of the infantry weapon and absence of smoke on both sides will make it easier for the skirmisher to pick off the gunners. Captain Moch[1] relates an incident at the battle of Sedan which has a bearing on this subject. A Bavarian skirmisher had established himself among the branches of a tree within easy range of some French infantry lining a wall near Balan. From this position he kept picking off the men at a particular part of the wall, and it was a considerable time before the smoke proceeding from the tree betrayed him. Similar feats will now be more easy; and if this was done against infantry, why not against artillery?

Machine-Guns.

The effect of smokeless powder on machine-guns is probably more distinctly to their advantage than it is to any of the other arms. The successful employment of these weapons depends mainly on their not being knocked to pieces or caused to retire by the enemy's guns in the earlier stages of the fight. Smokeless powder will render it next to impossible for artillery to distinguish their position, if well placed, and therefore they no longer offer such a target as they did in the Franco-German battles. That being so, they remain available for turning their whole attention to hostile infantry or to any artillery or cavalry which venture within effective range of them.

As regards the firing of the machine-guns themselves, it is well known that with black powder it is impossible for the firer to see over the sights after the first round or two. With smokeless powder that difficulty disappears, and continuous accurate fire can be kept up at all critical moments. The effect does not, as with artillery, depend on the accuracy of one shot, but on that of a quick succession of shots.

[1] "Revue d'Artillerie," p. 394, 1889.

Thus, with the old powder the machine-gun in action was seen without being able to see the enemy. Now the firer can see the enemy without being seen.

The Command of an Army in Battle.

Formerly two lines of smoke showed the Commander-in-chief and his subordinates the exact respective positions of the combatants. This will be the case no longer. The Commander of an army, or even of an army corps, must still further rely on the reports of others and see with their eyes. On the other hand, a better general view of the country will be obtainable, and the approach of large masses will not remain undiscovered. Austrian Officers state that the Crown Prince's troops gained Chlum, the key of the Königgratz position, unseen, through the air being thick with powder smoke. This is not likely to happen again. Perhaps, also, the smoke of the German guns and French infantry hid from the latter the strength of the Saxon turning movement at St. Privat.

Effect of Smokeless Powder and Magazine Rifles on Cavalry.

"Cavalry will suffer more than any other branch of the Service by the introduction of smokeless powder, for their best friend was always the smoke which veiled their attack and which always made difficulties for the infantry in finding the object aimed at,"[1] writes a German Officer on the subject. Let us examine how far his opinion may be accepted.

At Mars la Tour, the great modern battle in which cavalry played an important part, we find that every charge made against infantry or artillery was directed against their *front*. Bredow's was against the front of 12 guns and swept through them to fall on infantry and cavalry in rear. Doubtless the smoke of the guns assisted the ground in concealing the onset (for the cavalry were not seen till within 400 yards of the guns), and little loss was experienced in this first stage. It was during the retreat for more than a mile through a large part of the French Army that the great loss took place. Thus the disadvantage of attacking the front, whether of guns or infantry, is clear, and this disadvantage will, no doubt, be so much increased by the absence of smoke and the improvement in weapons, that it will require *very* favourable circumstances and formation of ground to allow any chance of success to such a charge.

It is to be remembered, however, that these same causes have necessitated much more open formations for infantry, which now fight practically in long thin lines. It is considered also that in open ground, such as is favourable for cavalry, the supports and reserves of infantry will have to deploy in like manner. That being so, their front is evidently very strong against cavalry attack, but their flanks become proportionately weaker, for there may exist no closed bodies

[1] Bieberstein "Colburn's U.S. Mag.," February, 1890, p. 399. (Translation.)

ready to bring fire to bear on a flank except those far in rear. The flanks of artillery are also weak in themselves and require protection from the other arms. It has always been the case that cavalry attack is most to be feared and has greatest chances of success from a *flank*. These chances are not, therefore, affected so much by the improvement in weapons, and such an attack can be supported by infantry or artillery fire to the last moment. When the cavalry has swept along the hostile line, the distance it has to retreat under fire is comparatively short, and very different from that which Bredow's cavalry had to traverse.

Such opportunities for flank attacks may not often occur, but as they promise great results in giving breathing time, when the infantry are overmatched, they will be sought after by enterprising cavalry leaders. No doubt if all battlefields were perfectly flat plains where every movement could be seen for miles, or consisted of impracticable country, the cavalry *rôle* would be limited to watching the flanks of the enemy and opposing enterprises by hostile cavalry. But it is seldom that places cannot be found where considerable bodies of cavalry may remain hidden and move for considerable distances unseen. When such are obtainable they give much more effective cover than smoke. Here, again, we find increased importance attached to the formation of the ground and the intelligent use of it.

As illustrating what may be done in war by what has happened in peace, at the German manœuvres[1] of 1879 a regiment of lancers surprised and charged four battalions who did not see them till within 200 yards of their flank. Scarcely a shot was fired before they were among the infantry. The decision given, with the approval of the Emperor and von Moltke, was that three battalions were placed *hors de combat*. The Colonel commanding the lancers had moved personally to a well-chosen spot, had been quietly observing the movements of the infantry, himself unseen up to the moment when he gave the signal to his regiment to charge.

The service of reconnaissance is, however, now of such importance and will harass cavalry to such an extent, that it is unlikely that large bodies of that arm will be used actually on the battlefield. Small bodies, say not larger than a regiment, will move faster, be more easily hidden, and not so readily thrown into confusion, and will, therefore, fulfil the duty of suprising an enemy better than large masses of horsemen such as appear to find favour in Germany at the present moment. Single horsemen may also be found most useful actually on the field of battle to discover movements of the enemy. As Prince Kraft[2] observes, such small objects as individual horsemen are unlikely to attract fire, such is the power of hostile fire to engross the attention of infantry and artillery in action.

As regards the dismounted action of cavalry, the magazine carbine will doubtless add considerably to the defensive power of the arm, in holding defiles, bridges, &c.

Against routed infantry, cavalry are likely to act as effectively as

[1] Article on "War," "Encyclopædia Britannica."
[2] "7th Letter on Cavalry."

ever, for then it matters little whether the former are armed with pitchforks or with magazine rifles, for they will be incapable of using them.

Reconnaissance.—It is perhaps in the duties of reconnaissance that cavalry (and infantry also when thus employed) will find the greatest change in comparison with the same under the old conditions. With the old powder, the first shot fired at a patrol gave warning of the exact position of an enemy. With smokeless powder this is no longer the case, and all that can be expected is that the path of the bullet may give roughly the direction of the firer and the sound some idea of the range. A cavalry patrol, stopped by rifle fire with the old powder, could on its return give some information of the enemy's position, but with the new their report must be more meagre, and their chances of having been surprised by an ambush of magazine fire greater. Hence reconnaissance must in future be more costly. The same holding good on both sides, it ought to be easier to cover one's own front and prevent the enemy's patrols penetrating the screen. The result of all this will be to enhance the value of good eyesight and aids to vision, such as field glasses. The troops which are clothed in the least brilliant uniform and equipped with the least shiny accoutrements will hold a great advantage over the other side, with cavalry as with infantry. Grey horses will be at a great disadvantage. It follows, that training selected men in peace time in the observation of distant objects and in sending reports will be as important to the cavalry as training in observation of fire is to the artillery. As one man can see as well as fifty, and can move more quickly and is much less likely to be seen, officers' patrols will become more common and more important in their results. It may sometimes be necessary to send all the officers of a squadron, except the Captain, on these duties. This will necessitate, on the other side, more frequent patrols between parallel columns to guard against the enterprise of these officers.

The general result will be that it is impossible for cavalry alone to reconnoitre an enemy in position, though sometimes the configuration of the ground may give intelligent officers a shrewd idea of his position. General Ferron's orders[1] to the 18th Army Corps, at the French Manœuvres this year, were that cavalry patrols must halt as soon as within the zone of effective fire, and infantry companies were to advance on the flanks and drive back the enemy's posts, officers being in rear with good field glasses. Thus we get the two extremes, officers' patrols and reconnaissances in force.

Outposts, as affected by Magazine Rifles and Smokeless Powder.

From what has been said above, it is evident that the precise position of the outpost line will be more difficult to make out. The sentry who gives the alarm by firing his rifle need not thereby betray his position, and, in spite of what has been said to the contrary, the noise of the report is quite sufficient to reach the picquet.

[1] "Army and Navy Gazette," July 26th, 1890.

This difficulty in getting information of the outpost line will make it all the more necessary to surprise sentries and picquets, for the results will be more valuable. The flash of a rifle being seen at night, while invisible by day, may cause attempts on the outposts by night to become more frequent. All this means harder and more harassing work on outpost duty, but the superior defensive power of the modern rifle ought to alleviate this by reducing the number of men necessary in the outpost line when in contact with an enemy. Thus, where 1,000 men per mile were formerly necessary, 600 or 700 may now suffice, as long as the line of observation is not thereby reduced.

Guerilla Warfare.—The facilities afforded for surprising patrols, &c., by means of improved weapons and ammunition, will add to the power of the guerilla in ambushing and harassing an enemy. It must be met on the other side by increased watchfulness and activity in reconnaissance.

Résumé.

The effects of smokeless powder on the minor tactics of the future may be briefly summed up as follows:—

Infantry.—1. Increased facilities for fire discipline and control.

2. Improved shooting individually, both in rapidity and accuracy.

3. Non-betrayal of presence of skirmishers in broken ground, of sentries on outpost duty, or of firing line of defence.

4. Increased facilities for commanders of units combining action with adjacent units.

On the other hand:—

5. Exposure of moving bodies, such as attacking lines, supports, and reserves.

6. Consequently deployment will take place further away from enemy.

7. And the strength of the defence against frontal attack over open ground will be increased, but not over cramped ground.

8. Greater importance of cover.

Morale probably gains in respect of men knowing what they are about, but loses by reason of their seeing comrades fall around them, especially on the defensive, and by not knowing where the bullets come from, more particularly on the offensive.

Artillery.—1. Improved shooting and fire discipline.

2. Increased rapidity of fire.

3. Slightly reduced weight of ammunition.

4. Greater possibility of masking batteries, and their position remaining undiscovered. Hence importance of cover.

5. Observations of fire easier, if large object in neighbourhood of enemy's guns be chosen to regulate fire by, and not guns themselves unless plainly seen. Otherwise observation of fire more difficult.

6. Tiers of fire possible.

7. Guns must unlimber out of sight when possible, and be run up into position by hand.

8. Advantage of first fire make long ranges probable at first.
9. Greater facilities for supporting an infantry attack from a distance.
10. A larger number of guns can be brought into action in a given space.
11. Approach of infantry masses to attack guns cannot be made unseen as at Königgratz.
But 12. Individual skirmishers thus approaching in cramped ground and picking off gunners will be difficult to detect.
13. Changes of position will be more open to view, and therefore more dangerous than formerly.
14. Since smokeless powder gives the best results when detonated, it becomes almost a necessity to introduce metal cartridge cases with the necessary detonating arrangements.
Machine-Guns.—1. Invisibility to enemy's artillery.
2. Possibility of keeping up continuous and accurate fire without stopping to relay the gun.
But 3. Changes of position open to view.
Cavalry.—In conjunction with magazine rifles the effect of smokeless powder on cavalry will be:—
1. Possibly fewer chances for charging other arms than before, since the front of infantry and artillery will generally be invulnerable.
2. Nevertheless chances for flank attacks will still occur.
3. These attacks will probably not be undertaken by larger bodies than a regiment.
4. Increased difficulty of reconnaissance and probable necessity for adding to the offensive fire power of cavalry.
5. Greater power of holding bridges and defiles when dismounted.
Common to all Arms.—1. Greater visibility in motion.
2. Increased invisibility at rest.
3. Increased importance of making use of ground as cover.
4. Probability of reconnaissance by night becoming more frequent.
5. Impossibility of retreating under cover of smoke and consequent increased loss to the vanquished.
6. Preliminary stages of fight will take a longer time, though once within decisive range the decision will be more quickly brought about.
7. Necessity for neutral tinted uniform and equipment.

Magazine Rifles.

Evil Results foretold.—The introduction of these weapons was not accomplished without a great deal of criticism and ominous prophecies on the part of not a few authorities. It was foretold that they would cause an immense waste of ammunition and an entire absence of fire control. These critics have not yet been proved wrong by actual war experience, but it is probable that careful thought, combined with experiments, will show us how to avoid the evils prophesied. No doubt a mob, or even badly-trained soldiers, armed with magazine

rifles, would do no better than if they had merely single-loaders, provided the same amount of ammunition were supplied in both cases, but fire discipline of the strictest kind ought to go a long way towards getting over the difficulties which lie in the way of developing the power of the new weapon. That due to smoke blinding the fire after the first round or two has already been got over, and the absence of smoke will also assist the commander in the general control of his unit. Without smokeless powder it is doubtful whether any great advantage would be reaped from the introduction of magazine rifles.

Nature of the Weapon.—The weapons of themselves do not appear to warrant any revolution in tactics. They simply mean giving to troops the power of firing for a time considerably more rapidly than with a single-loader. Colonel Löbell[1] says: "The rifle as a repeater offers to the soldier a constant and continuous readiness to fire, which is preserved by means of its careful and judicious application, and by a continual and timely filling up of the magazine. The soldier must bear in mind that his arm increases the necessity for a thorough fire discipline, and that the repeating arrangement is intended to heighten the actual effect of the fire, and not only to increase its rapidity." Superior range and flatter trajectory add to the increased power of the weapon, while smokeless powder makes the shooting more accurate, and the result is that troops will fight at greater distances and in less vulnerable formations than formerly. "Changes in arms usually produce modifications in tactics, but as a rule in the *tactical formations* only, and not in the principles of the combat as regards attack and defence."[2]

Chief Difficulty lies in Regulation of Fire.—As inferred above, it is in fire discipline that the chief difficulty with the magazine rifle will be experienced. The increase of power now placed in the hands of the soldier may be entirely wasted if not applied at the right moment and on the right object.

Means of Overcoming this Difficulty.—"When firing once begins men easily get out of hand unless restrained by an iron discipline," says Prince Kraft. "Fire discipline means decentralization of authority; no superior can properly control more than four to eight subordinates, so let this be recognized and carried out through everything, and let each superior be allowed the control of this limited number."[3] Foreign regulations now recognize as necessary such extreme decentralization. The Germans divide their zugs into groups of eight men under a non-commissioned officer for purposes of fire discipline, and this system is also followed by France and Austria. Against smoothbores control of fire and volley firing by battalions was the custom. With every improvement in weapons this unit of fire control becomes smaller; thus, with breechloaders in the War of 1870, it was attempted to control the fire of companies of 250 men almost direct from the Captain. The attempt signally failed, because that number

[1] "R.U.S.I. Journal," vol. xxxii, p. 841.
[2] "Changes in Military Matters during 1887," "R.U.S.I. Journal," vol. xxxii, p. 838.
[3] "Discipline," "R.U.S.I. Journal," vol. xxxiii, p. 305.

made too large a unit for the weapon against them. The German system of training of the day had not contemplated such decentralization as was really necessary for the efficient conduct of fire, and therefore in most cases the fire degenerated into simple independent firing. In the French Army apparently fire discipline was almost unknown at that time. Hence, as a result of the experiences of that war, the present Continental system of decentralization, extending down to groups of about eight men, has grown up. Such a number as this, besides being easy to control, will present but a small mark for an enemy. If this system be accepted let the training of men in peace time all tend in that direction. The confusion of the battlefield and the mixture of units is bound to take place again as it did in 1870. Our task is to make the confusion more apparent than real, and if the units be so small they can hang together longer.

The Decisive Range.—But what, after all, is the infantry fight? A German authority[1] tells us: "The infantry fight will resolve itself into a prolonged and costly struggle, necessitating bringing up the rear lines. Their *rôle* will be to feed the fighting line and replace the waste, thus becoming a mere source of supply. . . . . The absurd idea of attempting to decide the issue by attacking with masses of troops brought up from the rear in close formation must needs suffer considerable modification, 1st. Because they will have to be dissolved to feed the fighting line; 2nd. Because it will be quite impossible for the masses to traverse the fire zone."

The distance at which the "prolonged and costly struggle" will take place will doubtless vary according to the ground. On open ground, owing to the flatter trajectory and superior accuracy of the present rifle, it will probably be greater than in the days of single-loaders. A writer in the "Militär Wochenblatt,"[2] estimates it during the last wars at 200 to 300 metres. "In the wars of the future," he says, "the decisive fusillade will take place at 300 to 400 metres, or even more." General Ferron,[3] in his instructions to the 18th Army Corps, this year, tells his subordinates that, owing to magazine rifles and the absence of smoke, the object of the attack is to constitute a firing line at 700 to 400 metres superior to the enemy and then force him to quit by artillery and infantry fire combined.

It seems probable, judging by past experience of changes in weapons, that the above views are correct, and that over *open ground* the decisive magazine fusillade will take place somewhere from 300 to 700 yards from the enemy. When the ground allows a nearer approach, however, the combatants may get much closer. At Majuba,[4] the critical moment occurred when the Boers were within 30 or 40 yards of our line, and the formation of the ground would not have allowed that distance to be varied with either magazine rifles or muzzle-loaders.

[1] Major Keim, "Present State of Tactical Science," "R.U.S.I. Journal," No. 152, p. 548.
[2] 1st Article, No. 106.
[3] "Army and Navy Gazette," July 26th, 1890.
[4] "Carter's History of the Boer War."

The Attack.—The task for the attack is, then, to find out means by which this powerful line of fire can be brought up to the decisive distance with the least possible loss in men, morale, and fire discipline. The nations of the Continent have solved the question much in the same way as far as can be done without actual war, the solution being, by general consent, lines of men in extended order constituting the firing line, followed by supports and reserves whose duty it is to feed this line and urge it forward. Yet voices are occasionally raised against many details of this system, owing to the difficulty of controlling men in extended order, and of preventing straggling. Perhaps the most remarkable protest is the "Summer Night's Dream," a translation of which from the German appeared in the United Service Magazine.[1] The writer hopes to find a remedy for the fire discipline difficulty, and for the immense amount of straggling which took place in 1870, in "rejuvenated linear tactics, suitable for modern fighting and consisting of handy single ranks with no depth of formation." The real fighting unit is fixed at a quarter of a German company, or about fifty men, which must advance in single rank in line, the men keeping the touch when the ground allows of it, and firing volleys by word of command. By an iron discipline men are not allowed to take cover in ditches and other places from which it might be difficult to move them for a further advance. The cover allowed to the firing line appears to be only what can be obtained by lying down, which is done by word of command. This system bears a remarkable resemblance to the method of attack at present laid down for our Service in many particulars, and also to that of the French Army, as employed at this year's manœuvres.

Means for attaining the Main Object.—Keeping our main object in view, viz., the establishment of a powerful firing line at decisive distance from the enemy, let us consider how to get this firing line up to this position.

(1.) *Covering Fire.*—It is evident that the enemy must have his attention distracted, and must be kept from showing himself above his shelter trenches by *covering fire*, which must be kept up as long as possible. Here comes in the immense importance of the shape of the ground, which to favour the attack should enable such covering fire to be kept up till the arrival of the firing line at the decisive distance. Apart from artillery, it is probable that the increased range of modern rifles will enable effective covering fire to be made use of by infantry reserves, as is said to have been done by the Boers at Majuba.

(2.) *Rapid Advance.*—The fighting line should be exposed to the enemy's fire for as short a time as possible. Therefore it must move forward as quickly as is consistent with steadiness and with arriving at the desired distance without unduly fatiguing the men.

(3.) *Powerful Firing Line under Strict Control.*—The firing line should be as powerful as possible without crowding. As the author

[1] June, July, and August, 1890.

of the "Summer Night's Dream" conclusively proves, this is only to be done by placing men in one line, and therefore any system in which men are not closely connected appears to be founded on wrong principles. The old extended order was only suitable for skirmishers who were so far apart as not to interfere with each other's fire. "The skirmisher placed in a dense line has in reality no more freedom in choice of cover than the man in close order."[1] He cannot go forwards or backwards to seek cover without interfering with his neighbour's fire. "The best way of avoiding the effect of the enemy's fire is to lie down, and troops in close order can do this as easily as firing lines. Our company columns are skilled in the art of utilizing natural features of the ground to approach an enemy unseen."[2] Again as regards thin skirmishing lines: "I do not dispute the value of thin lines of skirmishers when no serious engagement is intended. . . . . But if you are going to commence your attack with so thin a firing line as to have 5 or 6 paces interval between files, your skirmishers will indeed have smaller losses, but your troops in close order (supports) greater losses. The enemy who opposes you with a dense firing line will have, with an equal front, twice or three times the number of rifles in action. Your reinforcements on their way up will be insufficiently protected by the firing line and will be annihilated. . . . . Fire discipline will be difficult from the outset."[3] After describing how he would have the units open ranks to pass obstacles in cramped ground, he goes on: "It is precisely in cramped country that you must need cohesion and dash since all the advantages are on the side of the determined attack. Nowhere is extended order, *when constantly maintained*, more unsuitable and dangerous than in such country." How true this was of the wood fighting in 1870.

It is self-evident that such comparatively close order will make fire discipline and control more easy, and therefore the fire will be more effective and its effect on the enemy greater. Consequently, fewer men will be lost, for the formation will lose least which can do most injury to an enemy; and troops in single rank keeping the touch really offer no better target than clouds of skirmishers. Finally, troops in such definite formations would be much more likely to march forward than those in extended order with all its attendant evils. This is sufficiently illustrated by the writer of the pamphlet above mentioned, when he describes[4] how, in a battle in 1870, his men, who were holding together and advancing, suddenly disappeared in every direction but that of the enemy, when ordered to extend by a superior officer.

The conclusion is therefore arrived at that the firing line, to be really powerful, effective, and under control, should be composed of a line of men, allowing a yard per man, the whole line to be split up into units each of which has its leader and second in command, this decentralization of authority extending down to groups of about eight men.

[1] "Summer Night's Dream," "U.S.M.," p. 213. [2] *Ibid.*
[3] P. 214. [4] P. 359.

It is most probable that Colonel Hallen aims at getting much nearer the enemy for the decisive combat, and in much larger units than will be possible with modern weapons, but the "Dream" itself must be taken more as mere special pleading on behalf of fire discipline. Firing must and will commence as soon as serious losses begin to be experienced, so long as the enemy's position can be made out.

After condemning the advance under heavy fire without returning it, Major Keim says:[1] "Why should a body of troops, weakened both physically and morally, be supposed to have better chances of getting up sooner and nearer to the enemy than another whose advance is carried out under considerably more favourable tactical and moral conditions? This theory might hold good against an enemy inferior both in shooting power and bravery."

It is well known that fire becomes less effective when hostile fire is suddenly opened on the firers. Once the attacking line begins to fire its prime object must be to see the enemy and not to seek cover in the folds of the ground, where this prevents effective fire. It is to be remembered, however, that halting to fire means a certain amount of delay and loss of *élan*, and each halt for that purpose should only last long enough to give men breathing time. It is stated that the repulse at Laing's Nek was partly due to mounted Officers hurrying on men on foot with more zeal than discretion, till the latter were completely blown; and we have the disaster of the 38th Brigade at Mars-la-Tour to remind us how useless men are when tired out. Those who have taken part in an attack at a field day over 3,000 yards of country know well how fatiguing it is to men engaged in it. The time for halting to fire will therefore be grasped by commanders of units when they see their men can go no further in good order, through losses, fatigue, &c. When once this takes place it is probable that some reinforcement by supports will be necessary, as "impulsive power" once lost is difficult to regain.

(4.) *Volley Firing.*—As regards the method of firing, it seems likely that volley firing could be carried out by units of fifty men or so to begin with, but we cannot hope for this to be continued to the later stages of the attack. The nearer the combatants approach, the greater the losses and the louder the din of battle. Under such exciting circumstances, the units under control for firing volleys can no longer be so large as fifty men, even after deducting losses, and therefore the volleys will presently become section volleys and then group magazine volleys, till at last, even with the best disciplined troops and a stubborn enemy, independent magazine fire will decide the contest. Many authorities think the days of volley firing are past, but we may "leave the question with the remark that the moral effect produced by a volley is too great for the attempt to use it ever to be willingly thrown away, but that it would be now rash to take for granted that on service the best troops can be depended on to deliver, during close fighting, accurate volleys, unless it be in small

[1] "Present State of Tactical Science," "R.U.S.I. Journal," No. 152, p. 546.

this principle, and lays down the minimum reinforcing unit at a section. In the case of the mixing of units it is to be observed that the mixing of the companies of one battalion is much less harmful than the mixing of different battalions, for every soldier knows the Officers of the battalion by sight at least, and most of the non-commissioned officers, so that the men are much more likely to obey them than total strangers. As regards (*b*), it must happen that the number required to fill up the gaps will often be under or over estimated. The former error is easily rectified by more troops, and when the latter takes place, Colonel Hallen's plan, of teaching the overlapping men to fire in two ranks, seems the most natural remedy. In order to fulfil (*c*) and carry the whole line forward, the system described in the "Summer Night's Dream" seems, again, to be in accordance with common sense. By each reinforcing unit advancing *through* the gap and lying down to fire some 50 yards beyond, it is reasonable to suppose that the remainder of the line would be impelled to move up to or beyond them. Naturally the units nearest the gap must cease fire when the reinforcement passes through. Thus the further advance will resolve itself into alternate rushes, every rush being covered by fire from the units lying down. Prince Kraft says:[1] "When a part of the skirmishers has taken up its position near to the enemy and has opened fire, honour and comradeship compel all the other skirmishers to hurry up to them in order to share their danger shoulder to shoulder and to fight with them. The moment when the echelon which has gone first to the front opens its fire is the most favourable for all others to gain ground quickly, since the enemy will, at this moment, direct all his rifles at those skirmishers which have the first advanced."

The Final Stage.—As before stated, the final crisis of the fight will take place at any distance up to about 700 yards, according to the nature of the ground and the enemy. The result of the combat will depend on which side can bring the most rapid and deadly fire to bear on the other. Until the fire of one side or the other is got under no bayonet charge or further advance can possibly take place at such deadly range, for to advance across the open would give the advantage of fire to the enemy. The time necessary to get over even 200 yards would suffice for the other side to turn the tables unless his fire had been almost completely subdued.

Flank Counter-attacks.—During this period flank counter-attacks are much to be feared, and the magazine rifle increases their power just as the B.L. did as compared with the M.L. Prince Kraft says:[2] "It is quite true that pressure on a flank has now tenfold power," and relates how at St. Privat a line of nine French battalions which were annoying his guns and could not be driven back by frontal fire, retired at once when taken in flank by one single German company. How much more would this be the case with magazine rifles? Therefore especial care must be taken, by means of echelons of troops, to protect the exposed flanks of the attack.

[1] "12th Letter on Infantry."
[2] "6th Letter on Infantry."

Retreats under Fire.—Whichever side is driven back must suffer enormously in its retreat through the far-reaching power of the new arm, and this must more particularly be the case where the ground—as at Majuba—allows the combatants to approach close to each other before the fight is decided.

Normal Attack Formations.—As regards the exact drill of the attack, the latest German regulations lay down no normal formation, and any such is absolutely prohibited from being drawn up or practised. So far, however, they are the only nation which adopts this plan. On this subject Colonel Slade remarks:[1] "The German idea is that the young soldier, if once disciplined, ought not to be practised in a stereotyped form of attack which the varying circumstances of actual combat might not render suitable; but that if practised to act according to circumstances he is less likely to be hurried and confused when called upon suddenly to meet the enemy." It seems necessary, however, that the system of attack should be laid down sufficiently to ensure all regiments being able to work together without a hitch, and to guard against the danger of new and strange methods and words of command being introduced by too zealous Commanding Officers. The system should be sufficiently elastic to be adapted for all sorts of ground and the nature of the enemy, but the principles laid down must be the same throughout an army. It must be remembered that "most men become neither wiser nor more sagacious in the turmoil of battle—rather the reverse. The possibility, therefore, of correctly perceiving at the moment what measures and formations are required during an action should not be relied on."[2] On the whole it looks rather as if the Germans were trying a dangerous experiment. Most normal formations (*e.g.*, our own) contemplate the firing line advancing to within about 150 yards of the enemy before the crisis takes place. Though it is well to lay down in theory that it is necessary to get as near your enemy as possible, yet in practice it is very unlikely that the attack will be able to advance so far till the enemy's fire is completely subdued, except, perhaps, in cramped country, where the distance separating the combatants may even be much less.

The principles to be followed, therefore, in the infantry attack may be summed up as below:—

Résumé.—(1.) Covering fire to be made use of as much as possible.

(2.) The firing line should advance as quickly as possible, consistent with arriving at decisive range without undue fatigue, and therefore should not open fire till absolutely necessary.

(3.) The firing line should be as powerful as possible, consistent with each man being able to make full use of his rifle. The alignment should be kept in each unit.

(4.) Volley firing should be the rule.

(5.) Supports and reserves must avail themselves of all cover

[1] Lecture at Aldershot, 1889, p. 11.

[2] "Present State of Tactical Science," Major Keim, "R.U.S.I. Journal," No. 152, p. 544.

possible, consistent with due support of the firing line, which latter must consider fire efficiency before considerations of cover.

(6.) When necessary, the impetus to the firing line for a further advance must be given by supports, in complete units, advancing *beyond* the firing line.

(7.) The advance of one part of the line must be covered by fire from the other.

(8.) Flanks should be very carefully guarded.

For the carrying out of these principles under hot fire, every unit must have a 2nd and 3rd in command told off. As this may not be possible with groups of eight men, the remains of those groups which have lost their leaders must be trained to join neighbouring groups. The fire must be regulated by whistles, each leader and possible leader being provided with one. Straggling being the great evil, Colonel Hallen's suggestion for "battle police" seems likely to go some way towards remedying this. Their powers over individual stragglers would, however, have to be unlimited on the battlefield.

General Conclusions.—The conditions for the frontal attack by infantry have so much altered since the introduction of smokeless powder and magazine rifles, and altered for the most part to the advantage of the defence, that a serious frontal attack over open ground, against infantry in position, unless enormous superiority in artillery is obtained, will hardly be attempted in the future, except against indifferent troops. But the fact must not be forgotten that every increase of power to firearms also benefits the attacker, as regards covering fire, *once he has brought to bear fire superior to that of the enemy*, and the greater range allows greater concentration of this covering fire on the predetermined spot. This, combined with increased fire discipline, greater skill in making use of ground, and improved formations, may yet have unexpected successes in store for the determined attack.

The Defence.—The results of the introduction of magazine rifles to the defence appear to be simply to emphasize those produced by breechloaders, and further strengthen the front of infantry in position. Smokeless powder also enables full use to be made of the magazine, and gives it the power of inflicting a maximum of damage in a minimum of time. Thus it is a weapon of opportunity, and to get full value out of it magazine fire should be used at any range, so long as the target is proportionately large. But such firing should be conducted by rapid magazine volleys, and no independent fire should be allowed. Thus, magazine volleys might be used at supports and reserves of the attackers, which showed themselves in sufficiently dense formation to present a good target for the range, or at a battery of artillery coming into action up to 2,000 yards. But, naturally, the main use of the magazine will be at short ranges, when the crisis of the fight has arrived, or at cavalry or a retreating enemy. For proper control of fire under these circumstances, discipline must be, as it were, "instilled into the very limbs of the men," either for the attack or the defence.

Since open ground will generally be avoided by the assailant, the

defender must economize men by holding such portions of the position very lightly, and place the greater part of his force on the flanks and where the ground is broken or cramped and the view not extensive.

Field Fortification.

Shelter-trenches and gun-cover will be made more use of than ever in future, both by the attack and defence, in the former case to secure ground gained, or to make the front safe, so as to enable more troops being sent to turn a flank. On the defence, however, such cover will tend to disclose the position of the fighting line and guns, which might otherwise, through smokeless powder, escape notice. Therefore, the positions for these entrenchments will have to be judiciously chosen, and freshly turned earth must be covered with turf or branches of trees in order to mask its position.

Experiments have shown that the penetration of the new British rifle amounts to 36 inches of soft wood at 40 yards, but only about 2 feet of earth at 160 yards, while on meeting with stones in the earth the bullet sets up and goes no further. Foreign rifles, probably, give similar results, and, therefore, the best style of cover to construct is indicated by these facts. Artillery fire, in future, being mainly shrapnel, a great thickness of earthen parapet is not so necessary as is depth of cover to escape its searching effects. Head cover will also be sought after for the same reason. On the other hand, stockades may be said to have become worthless, compared with the amount of labour necessary in constructing them, unless made of such solid material as iron rails.

Machine-Guns.

Introductory.—In considering the effect of these weapons on the tactics of the future, we find a great lack of instances of their successful and proper use in civilized warfare in the past, though the principle of this weapon is no longer a novelty in the military world. On this account it is difficult to illustrate our theories and arguments by quotations from records of occurrences in actual war. Hence a wide field is open for speculation and theory. Imagination must be largely brought into play, and a modern battlefield, in its great extent and confusion, must be pictured before the mind.

Nevertheless, some little use may be made of the experiences of the war of 1870–71, where mitrailleuses were extensively, though, generally speaking, most inefficiently, used on the side of the French. The same qualifying remark will, however, apply to the French artillery, which was lacking both in quality of matériel and in intelligent tactical handling to such an extent that there is scarcely an instance of its successful or satisfactory employment throughout the war.

If, then, the contrast between the value of bad and good artillery, on the French and German side respectively, is so striking, when

both sides had long been accustomed to the handling of that arm, why should not the contrast be equally striking between the value of the badly worked and inferior mitrailleuse, supplied to the troops only a few days before the war commenced, and the machine-gun, in its more perfect state of development, handled by men accustomed to its use, and trained in a system of tactics based on experience and common sense? The German artillery tactics of 1870 were evolved from the brains of men who had fought in the war of 1866, and had seen the comparative failure of the arm in that war; they made good use of this experience, and four years later the change in artillery tactics and its results were indeed marvellous. Why should not machine-guns and their tactics change in an equally remarkable manner?

Nature of the New Arm.—In talking of machine-guns, we assume that the weapons supplied to us can be depended on not to jamb at the critical moment, and that each weapon will be able to keep up an average fire of about 300 rounds per minute, for at least 10 minutes, and a lesser rate for a much longer period.

Machine-guns act by fire alone, and constitute a number of units of very mobile rifle fire (if well horsed). But, like artillery, they cannot use their fire when in motion, though, from the greater simplicity of their ammunition, these weapons can be brought into action more rapidly than artillery,[1] and being less bulky and lighter, they are more independent of circumstances. They can, therefore, act with great *suddenness*, but the nature of machine-gun fire adds great *intensity* to this suddenness, thus enabling the weapon to inflict a maximum of damage in a minimum of time. But as this fire proceeds from a very limited number of weapons, with less range than field-guns, it is obvious that artillery, by concentrating on each in turn, can silence them or cause their withdrawal when beyond effective range of machine-guns. In ranging, moreover, the latter stand at a great disadvantage as compared with artillery, for except on dry and sandy soil the limit of observation of fire is soon reached.

Comparing their fire with that of infantry, picked layers can be told off to each machine-gun, which, unlike a rifle, is fired from practically a fixed rest. Thus it is evident that greater control and accuracy of fire is to be expected from the machine-guns than from infantry, and consequently their effective range will be greater. Again, the space occupied on the march, or in line of battle, by machine-guns giving a certain volume of fire, is much less than that taken up by a body of infantry producing the same amount of fire. Yet infantry have a capability of acting independently over all sorts of ground on the offensive which can never be possessed by machine-guns.

Tactics as deduced from Experience.—Some idea of the future tactics of machine-guns may be gathered, as above stated, even from the

[1] The average time of the quickest battery at Okehampton in 1889, taken from coming into action to the 1st round fired, was 1 minute 24 seconds (Report by Colonel Murdoch).

experiences of 1870. The blunders of the French serve to bring into prominence only the more clearly the few occasions on which they did not commit errors. Yet, even with such mitrailleuses as they possessed, they produced 5 per cent. of the Prussian losses.[1]

We find in the early battles of that war (the only battles which can be profitably studied for our purpose) that the batteries of mitrailleuses were almost invariably pitted against the German artillery at considerable artillery ranges. At Weissembourg and Woerth especially, mitrailleuses are mentioned in such positions. They invariably drew the concentrated fire of the German guns on them, and were either destroyed or compelled to withdraw. This, then, is evidently *not* the way they should be employed in the future. But we have a few other instances of their employment. In the struggle about La Folie copse, at the battle of Gravelotte, we read:[2] "A mitrailleuse battery, in particular, on that high ground, commanded the north-west border of the copse, while another on the south corner of the latter swept the clearing between it and the Bois de Genivaux. . . . . General V. Blumenthal very speedily recognized the impracticability of an attack upon La Folie." The mitrailleuses here were evidently in the right place. They were secured from view of the German Artillery by the trees of the Bois de Genivaux.

Again, on the French left, the Prussian official account states:[3] "A mitrailleuse battery appears more especially to have been posted exactly in prolongation of the Gravelotte high road, and to have commanded it in the most effective manner." From this it is presumable that the mitrailleuse battery in question was to a great extent responsible for the disastrous ending of the attempt of the German cavalry and artillery to debouch from the road across the Mance ravine. Here, again, the mitrailleuses did their duty. The difference between their action in the above instances and at Woerth lies in the fact that at Gravelotte they were not pitted against artillery from the outset at long ranges, and when the German artillery did advance to St. Hubert, the mitrailleuses caught them coming into action at a range most favourable to the new weapon.

There is, however, a yet more striking example in the attack of the IXth German Corps artillery at the same battle. The official account of it is as follows:[4] "The artillery upon the spur south of the Bois de la Cusse was at this time in a very precarious position. A mitrailleuse battery had come into action at the most effective range, opposite the left flank of the Prussian line of guns. The 4th Heavy Battery in that neighbourhood, which had already sustained considerable loss from infantry fire, *was in a few minutes so damaged by the mitrailleuse fire* that several Officers, five gun commanders, and forty men were placed *hors de combat*, while nearly all the horses were killed or wounded." The further result of this was that four guns fell into the hands of the enemy. This, then, is a remarkable

[1] "Field Works," Colonel Brackenbury, p. 13.
[2] Part I, vol. ii, p. 29. Official account.
[3] *Ibid.*, p. 74. [4] *Ibid.*, p. 29.

instance of what the mitrailleuse could do when rightly handled. This shows it up in its proper value, as the torpedo-boat of the battle-field. In a naval action a torpedo-boat does not foolishly expose itself alone to the fire of a battle-ship. It is when the attention of the battle-ship is already engaged with another more equal opponent (or under cover of darkness) that the torpedo-boat finds its chance. The case is somewhat similar with machine-guns. When the attention of the enemy's artillery is already engaged in the heat of action, they may seek their opportunity, assisted by the undulations of the ground, which may hide them till they open fire. We have Prince Kraft's opinion,[1] that small bodies of cavalry may approach engaged infantry unnoticed, and he gives several instances of the excitement which absorbs the attention of troops engaged with an enemy. Smokeless powder will doubtless still further aid the machine-guns in remaining unobserved, even after they open fire. Why should they not approach in the manner anticipated for cavalry, and come into action against engaged infantry or artillery whose flanks are insufficiently protected?

From the above considerations, we gather that machine-guns with an army on the defensive will act in the following manner in the battles of the future:—

Tactics on the Defensive.—(1.) They will be stationed to sweep defiles, roads, command the debouches of woods and defiles, and flank the *points d'appui* of the main line, thus forming the *caponiers of the defence*, as it were. When exposed to artillery at considerable ranges they will not draw that fire on themselves by firing at very long machine-gun ranges, but will remain without attracting notice till the approach of the enemy's infantry.

(2.) There will be well-horsed machine-guns ready to dash out, in conjunction with cavalry, and take advantage of such an opportunity as was afforded by the IXth Corps artillery at the battle of Gravelotte.

To these two, based on the experience of the Franco-German War, a third might be added which has no experience to back it up, and is therefore pure theory.

(3.) A reserve of well-horsed machine-guns, possibly the same as those mentioned in (2), might be held available for galloping off to any point in the defence which is hardly pressed. Such timely support might save the post till the arrival of the slower moving infantry reserves, and on the danger being dissipated, the machine-guns might be withdrawn, and held ready to act in a similar way in another part of the field. In holding such a position as that of the Lisaine, it seems likely that machine-guns might be so used. At St. Privat also, though the French Guard arrived too late to restore the battle, mitrailleuses might have arrived in time if handled with boldness.

Examples of the employment of machine-guns by an attacking army we have none. But it seems probable that their action will be somewhat as follows:—

[1] "7th Letter on Cavalry."

Tactics on the Offensive.—(1.) They will economize infantry by securing the front, in conjunction with artillery, against counter-attack, thus enabling more troops to be employed in turning movements.

(2.) They will assist artillery in covering the advance of the infantry to the attack, thus rendering long-range covering fire by infantry reserves less necessary, for machine-gun fire is the truest long-range infantry fire.

(3.) They will advance into the captured position at the heels of the attackers, and by their steady and controlled fire will be invaluable for firing on the retreating defenders or for beating off a counter-attack by his reserves. At such stages of the battle, the range being short, their fire would be most deadly, and quickness in coming into action being a great desideratum, they ought to have the advantage of artillery in this respect.

In Close Country.—The discussion, thus far, has had reference merely to the use of machine-guns in fairly open country. It is now desirable to inquire into their relative action in a close country like England, where hedgerows and fences of every description prevent any important movement of mounted troops, except by roads and lanes; where woods and trees in the hedgerows obstruct the view and make long-range firing very difficult, except where a great command over the country exists. Any soldier who has seen the great open rolling slopes on most Continental battlefields, where unrestricted view can be obtained to long artillery ranges, and who then mentally compares those countries with what we usually see in England, cannot but come to the conclusion that England is essentially an *infantry* country. Field days at Aldershot naturally do not bring this home to us, for they take place on ground specially chosen for all arms. In fact, owing to economical considerations, it is hardly possible to fight mimic battles over enclosed land and realize properly what it means. Perhaps a War Game, fought over such country, may assist us to a certain extent in appreciating its difficulties. It shows us how hard it is to make proper use of cavalry, except as mere scouts and stop-gaps, and how difficult it is to get artillery into any position where they can see beyond infantry range sufficiently well to fire with effect. No doubt many suitable open spaces and commanding positions do occur about the Downs in the south, and the moors in the north, but, taking the country as a whole, it appears that—

(*a.*) Cavalry will be largely used to fight dismounted.

(*b.*) Artillery will not often find extensive positions from which proper use can be made of its long range, and even when they are obtained the fences will provide cover for an enemy.

(*c.*) When guns are once in position it will be difficult for them either to advance to support an attack or to retire—column of route being the only possible formation in motion. Consequently, the roads would soon become blocked with a mass of guns and infantry. Therefore, as a rule, the greater part of the guns would have to remain in one position throughout an action.

(*d.*) It would be very risky to send on artillery in advance of the infantry to commence the fight, unless the proposed artillery positions were previously seized and secured from sudden attacks. This might be done by mounted infantry or dismounted cavalry, with some machine-guns to command the avenues of approach leading from the enemy.

Similar conditions of country might, therefore, affect the tactics of machine-guns as follows:—

(*a.*) In consequence of the limited view of the artillery the machine-guns would not be so liable to be destroyed by the enemy's guns at long ranges nor captured by cavalry.

(*b.*) Owing to the difficulty which guns would have in supporting an attack, the machine-guns on the defensive would have little to fear from them in the close attack.

(*c.*) The characteristics of close country being that every road or lane constitutes a defile, except for extended infantry, great opportunities for the use of machine-guns on the defensive will present themselves.

(*d.*) Just as artillery and cavalry are prevented from making full use of their mobility in close country, so also machine-guns will find it difficult to get about, except by road. Hence they would, for the most part, only be able to assist in the attack by following up on the roads the advantages gained by the infantry in the fields, thus securing each bit of ground gained. Where, however, the enemy's position is a commanding one, they can assist the artillery in covering the advance of attacking infantry by their fire.

(*e.*) From the above it follows that, in close country, machine-guns need not be equipped for moving very rapidly, except those which are attached to the cavalry.

Power of Surprise by Machine-gun.—It is evident that one great characteristic of the machine-gun is the power it has for getting the very utmost value out of a *surprise* of the enemy. The introduction of this weapon may be expected, therefore, to affect the tactics of the other arms chiefly in causing them to guard against surprise with increased vigilance. Cavalry is an arm which will naturally be on the look-out for such surprises, and, therefore, the presence or absence of hostile machine-guns will be ascertained by them to the best of their power. Should bodies of cavalry come within range of these weapons, without being aware of their presence, the penalty they will pay is likely to make them more careful in future. The same may be said of closed bodies of infantry, and, even when deployed, the facilities machine-guns afford for rapid moves off to a flank, to enfilade a line, either attacking or defending, will cause flanks to be guarded with especial care. Prince Kraft's[1] instances of the preoccupied state of hotly engaged infantry and artillery teach us that such strokes by machine-guns are to be expected on the battlefields of the future. It is, however, the artillery which can do most harm to the machine-gun, and which, in turn, has most to fear from that weapon.

[1] "7th Letter on Cavalry."

Cavalry can bolt or charge, infantry can deploy or get under cover, on the arrival of a sudden shower of bullets, but with artillery it is different. Caught on the march, one horse shot in a team means keeping, perhaps, a large number of guns, men, and horses under deadly and concentrated fire for some minutes. If surprised in action from a flank, or in coming into action from close range in front (as at Gravelotte), it means a large loss in men and horses, and possibly also of guns, if the machine-gun attack is supported by other arms. Guns cannot charge, and it is against the principles of artillery to retire, even if sufficient horses were left to enable it to do so. Therefore, the guns must be brought to bear as quickly as possible on the unexpected and possibly unseen foe. By the time effective fire is attained, the greater part of the personnel of the batteries may be struck down. Hence, the introduction of the machine-gun may necessitate the addition of trained scouts to each battery or field artillery division, to look after their flanks in action, while on the march it will more than ever be advisable to have some infantry in front of the guns. Before coming into action the position chosen should be taken and secured in advance by mounted troops with machine-guns, both of which may give place to infantry when it comes up.

Machine-guns acting with Mounted Troops.—It is obvious, and has indeed been recognized in our Service, that machine-guns afford a welcome addition to the fire power of cavalry. In the future, we may see bodies of mounted troops consisting of cavalry, horse artillery, machine-guns, and mounted infantry acting the part of the delaying force with success. Had the French at Sedan possessed such a force and had it been sent to St. Menges when news of the German advance on that side first arrived, the mouth of the Falisette defile might have been held long enough to enable the French infantry from Floing to come up; at any rate, the bold advance of the German artillery from this defile might have had quite a different result. Had Benedek possessed such a force at Königgratz, it might have given him the means of checking the Crown Prince's advance sufficiently long to enable him to deal effectively with Prince Frederick Charles' army. Numberless similar instances of the possible employment of such a force might be given, either as retaining forces or for making raids for the purpose of seizing important strategical points.

In the Cavalry Combat.—It will now be necessary to discuss what assistance these weapons may give to cavalry and horse artillery in the cavalry combat. It is evident that their rapid and intense fire will find a very suitable target in masses of cavalry, and, being essentially a weapon of opportunity, they would appear to be very deadly against that rapidly moving arm. They have no fuzes to trouble about, and the ease with which the direction of fire can be altered by their traversing gear, while actually firing, makes it possible for them to follow with readiness any lateral movements of the hostile cavalry; the ranges in such combats would usually be suitable to machine-guns, and the extra height of the mounted man makes errors in range of less consequence. Yet they cannot displace horse artillery, for the latter arm is necessary, not only to keep in

check the enemy's guns, which might otherwise keep both cavalry and machine-guns at a distance, but also to shell villages or slight defences which a bullet cannot penetrate. Were there no horse artillery, a whole cavalry division might be effectively stopped by a few men in a building commanding a bridge or other defile. It is the *combined* action of the horse artillery and machine-guns which must be sought for in the cavalry combat; the longer-ranging weapon distracting the attention of the enemy, and his artillery, while the other manœuvres round in co-operation with the cavalry. Then, masked by their cavalry, machine-guns might approach within effective range of that of the enemy, and coming into action perhaps unobserved, while their cavalry clear their front, a few hundred rounds might be poured into the hostile mass in a very short space of time, and the moment seized by the cavalry to take advantage of the confusion in the hostile ranks and charge.

The possibility of manœuvres of this kind will add to the duties of horse artillery, as it will now have to attempt to destroy machine-guns of the enemy before they arrive within range, and the resulting contest opens a large field for speculation in the future.

Use with Outposts.—On the few occasions in which artillery are sent on outpost duty, the guns are usually employed to command bridges or defiles which hostile troops must pass before making an attack. Within certain ranges, machine-guns would evidently be more suitable for the purpose, and the continuous stream of bullets would forbid the passage to the enemy till artillery were brought to bear, and the machine-guns pounded at long ranges. Thus the object of gaining time for the army they protected would be fulfilled.

For the defence of such places, or even of open country, against night attack, the machine-gun possesses an attribute which makes it particularly valuable, viz., that it can be laid by daylight on the desired spot and at the desired range, and clamped in that position so that the fire loses nothing in accuracy through being delivered in darkness.

Chief Drawbacks to their Use.—It will have appeared from what has preceded that the two great drawbacks which machine-guns suffer from are—(1) being seen, and therefore silenced at long range by artillery; (2) the difficulty of ranging. The first of these is evidently considerably modified by the use of smokeless powder, and another recent development of science—the range-finder—will, it is expected, largely reduce the second. Range-finders may now be considered to have passed the experimental stage, and to have really become a factor in warfare to be reckoned on, more especially for machine-guns.

Conclusion.—In conclusion, we submit that though machine-guns seem destined to play a great part in future wars, yet they will not abate by one jot the importance of artillery. The *raison d'être* of artillery is to silence that of the enemy, and then prepare the way for the infantry attack by beating down and demoralizing that arm of the defenders, which, owing to magazine rifles, is now more impos-

sible than ever to approach, if intact. If, therefore, the artillery is not strong enough to silence the opposing artillery, either the attack will fail or it cannot be attempted, and the offensive will fall to the enemy. It is therefore absolutely necessary that the artillery be not reduced by a single gun, so that machine-guns may step in.

Quick-Firing Guns.

Definition.—By quick-firing guns are understood those machine-guns of which the calibre is greater than that laid down by the Geneva Convention as the limit for explosive projectiles, *i.e.*, those projecting shells of about 1 lb. weight and upwards.

Such weapons are mounted on non-recoil carriages, and when the calibre of the gun is so great as to cause its field-carriage to recoil, it must be relaid for every shot, and becomes practically a field artillery weapon and a single-loader. Mr. Nordenfelt says[1] that the heaviest quick-firing gun he can make, of which the recoil is absorbed by arrangements in the field-carriage, is a 7·7-pr. There is thus a considerable difference in the power of its shell and that of our 12-pr.

Arguments for and against their Introduction.—To put the question of the introduction of these weapons into a field army, as artillery, in as simple a manner as possible, the arguments on both sides are given below, so that the value of both may be compared:—

Arguments for their Introduction.	*Arguments against their Introduction.*
(a.) The fact of having non-recoil carriages, metal cartridges, and percussion locks, produces greatly augmented rapidity of fire compared with field guns.	A. Fire effect depends on weight of shell as well as rapidity of fire, and it is argued that one good 12-pr. shrapnel will have more effect than many of much smaller calibre and bullet capacity.
(b.) The enormous destructive and moral effects of the rapid projection of a number of shells on an enemy. The fire, it is said, can be continued for a number of rounds without relaying, and yet have sufficient accuracy.	B. Though theoretically it is unnecessary to lay the quick-firer for every round, yet, practically, this is not true. Mr. Nordenfelt[2] acknowledges that his 7·7-pr. has to be laid for every round at long ranges, and even at very short ranges, the accuracy is not great when not relaid.
(c.) Greater lightness of the gun as compared with the field gun.	C. The weight of the carriage and non-recoil arrangements have to be so great that the total weight of gun and carriage is brought up to that of the 12-pr. and carriage.

[1] "Quick-firing Guns in the Field," "R.U.S.I. Journal," vol. xxxii.
[2] *Ibid.*, p. 23.

	This is proved in Captain Maudry's work.[1]
(*d.*) Economy in men required to work the gun.	D. The quick-firer would really require as many men as the field gun, for the duties to be performed are very similar, and losses have to be provided against.
(*e.*) Capability, owing to non-recoil, of being fired from much steeper reverse slopes than field guns.	The number of men at the gun with the 12-pr. is only four, inclusive of the gunner bringing ammunition from the men at the limber, while Mr. Nordenfelt reckons the same number as required at his gun.

Thus all the arguments in favour of the quick-firer except (*e*) are answered on the other side.

In addition, there are the following objections to them:—

E. Against earthworks or buildings the 12-pr. common shell should have decidedly the best of it.

F. Waste of ammunition likely to be caused by the quick-firer. This, however, might be remedied by fire discipline.

G. Difficulty of observing bursts of such small shell.

H. If introduced in addition to the 12-pr. it means complication of ammunition.

I. Inferiority of quick-firer at long ranges as compared with a field gun.

K. The time taken to set fuzes prevents any very great rapidity of of fire being attained.

Conclusions.—Thus the weight of argument appears to be against the quick-firer for a field army. A firearm in the field must project either the smallest projectile capable of killing a man (like rifles and machine-guns), or its projectile must be as large and powerful as possible, consistent with mobility, in order to produce the greatest possible effect, be it man-killing or battering.

Yet the principle of quick-firing guns must not be thrown aside. Rapidity of fire at critical moments is of vital importance if accurate, and thirty shells bursting over a given area occupied by troops, in five minutes, would produce an infinitely greater effect than the same number spread over twenty minutes. The *destructive* effect produced varies directly as the quantity of shell showered on the area in question, but the *moral* effect may be said to vary inversely as the length of time during which these shells arrive. The reason for this is simply that the men have not time to recover from the shock produced on their nerves by seeing one effective shell, before another, equally destructive in its effects, arrives on the scene; and this increases as it goes on. Therefore we must seek to augment the rapidity with which field-guns can be fired. Theoretically, no more

[1] "Quick-firing Guns for Land Service," "R.A.I. Journal," 1889.

ammunition will be required, as a greater effect will be produced in a shorter time by a given number of rounds. Practically, however, some increase of ammunition will be necessary, but this question is discussed elsewhere.

Steps have been taken in the direction of increased rapidity of fire by the introduction of arrangements for checking the recoil of field-guns. By this means, also, guns will be able to come into action on steeper reverse slopes than at present. Shells will, in future, be carried into action ready-fuzed, and fuzes will be capable of more rapid setting. It is probable also, that shell and cartridge may be fitted together in brass cases and fired by percussion locks, but this means an increase of weight, for the cartridge cases necessary for this would weigh at least 2 lbs. each for the 12-pr. An improved system for supplying ammunition from the limbers and wagons will also tend towards the desired rapidity of fire at critical moments.

By means such as the above, once the opposing artillery get within decisive range, they will settle which is to be the victor in a shorter space of time, and the victors will be able to pay increased attention —now so necessary—to the opposing infantry.

Horse Artillery.—The question of supplying quick-firing guns to the horse artillery batteries with the cavalry division, is not open to quite such grave objections as in the case of field batteries. Horse artillery frequently have to fire a few shells very rapidly and then limber up. They have seldom to remain in action for very long, unless placed in line of battle with other guns, but probably in this case, as at Mars-la-Tour, they would be better employed with cavalry on the flanks. At the same time, guns with the cavalry division must have sufficient weight of shell to dislodge an enemy from a house hastily prepared for defence. Therefore, if a suitable non-recoil carriage can be constructed for a 7- or 8-pr., of sufficient lightness to be used as horse artillery, it is probable that the balance of advantage would lie in the substitution of such a weapon for the present 12-pr., though some disadvantage might occasionally be suffered from an enemy with a heavier projectile.

The other alternative is to substitute a lighter 12-pr. gun with 1,500 feet muzzle-velocity The carriage required for such a gun would be much lighter than the present one, and the recoil not so great. It appears a question of weight behind the team, and non-recoil *versus* calibre; but if a light 12-pr. and carriage can be constructed so that this total weight does not exceed 5½ cwt. per horse with limber packed and with small recoil, then we prefer such an armament to a reduction in calibre, provided that the ammunition be made up in a similar way to that of the quick-firing gun.

Higher Tactics.

The Offensive.—"Theory overlooks the fact that under normal conditions it is uncommonly difficult even to *initiate* an infantry attack, quite irrespective of carrying it through, as long as any important portion of the enemy's artillery remains effective. . . . Considering

the extraordinary precision of modern artillery fire as compared with that in past wars, an infantry attack which has to work its way through artillery fire in its principal phases has no prospect of success."[1] Even in the war of 1870, Major Keim says, this was practically the case, and shrapnel fire was unknown then. It is evident, therefore, that artillery has further developed its importance, and that side on which the artillery (in ordinary country) proves the stronger will alone be able to take the offensive. A great development of *covering fire* is to be sought for and expected, once the artillery duel is over, in order to enable the infantry to move forward to the attack with the least possible loss, and this covering fire will be mainly furnished by artillery and machine-guns, and probably by infantry reserves, when they can do so from a flank. Artillery and machine-guns must, however, fire over the heads of their infantry, and those troops which cannot stand this are useless for the attack.

Over open ground, the above-quoted authority remarks: "Neither the action of successive lines nor the mechanical pressure of reserves will ever suffice, in the battle of the future, to secure success for the assailant. Reserves must act independently to threaten the flank or line of retreat, or where they would have a strategic effect on the whole situation."[2] Such were the tactics carried out at the late French manœuvres at Cambrai,[3] and in the American Civil War, by Sherman against Johnston in Georgia. The characteristic of these tactics is the wide turning movement, and by this means the strength of the frontal defence can best be made use of by the offensive army. A smaller force than formerly can now be left to hold the front, and the co-operation of the divided forces can be better secured in these days of field telegraphs than used to be the case.

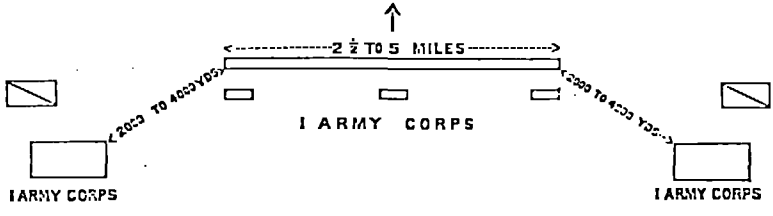
The Defensive.—Just as continuous lines in permanent fortification have given way to detached forts, with the improvement in weapons, so, in tactical battles of the future, defensible localities at intervals may take the place of continuous lines of defence, the intervals being left to artillery. Thus the defensive line will stretch so far that the enveloping attack system will become a matter of great difficulty. But this cannot go on for ever, and therefore certain weak points of the line being detected, Napoleon's plan of breaking in at the centre may again be illustrated in the future. This is the more probable because of the longer distance the defenders' reserves may have to march, and experience does not tell us that the hardest pressed point is easily recognized and reinforced.

Lines of Battle. The Attack.—Von der Goltz draws the following conclusions on this subject, at a time when magazine rifles, though contemplated, were not introduced: "Whilst up to this time it has been customary for five or six army corps to occupy the enemy in front, whilst another corps threw itself upon his flank and proved sufficient for the purpose, this proportion will perhaps be reversed in future." Without going so far as this, it seems likely that in an

[1] Major Keim, "R.U.S.I. Journal," No. 152, p. 544.
[2] *Ibid.*, p. 549.
[3] "Times," September 18th, 1890.

army of, say, three army corps, one of them might, on favourable ground, occupy the entire front, while the remaining two—masked by cavalry—attacked the enemy's flank or flanks, one or both, according to the tactical and strategical necessities of the situation. The cavalry veil covering the strategical advance will have its counterpart on the battlefield in the preliminary stages, and bodies of cavalry and infantry with machine-guns will spread out and occupy defensive positions over the whole front, once the enemy is ascertained to be in force too great for the advance-guard to sweep away. Under cover of this veil, the troops for the attack will be concentrated in the necessary directions, and the enemy must be fallen on both front and flanks simultaneously, though not necessarily in equal force in both directions.

The Defence.—As regards the defence of a position, the distribution of troops cannot but be much changed. On favourable ground, the front will be capable of being held by smaller numbers, and will leave larger reserves available to cover the flanks. This will be done, probably, by means of large detached bodies at distances varying from 2,000 to 4,000 yards on the right and left rear of the main line, connected, if necessary, by telegraph with headquarters. These detached bodies should be ready to fall, by order of the Commander-in-Chief, on any force making a flank attack on the main line, just as, at St. Privat, a similar detached force might have fallen on the Guards and Saxons when brought to a temporary standstill. Whether these detached bodies will be discovered by the attackers in time will depend largely on the relative strength and handling of the opposing cavalry, which arm will, on the flanks of the battlefield, have thus most important work to do. The defensive line of battle of three army corps may, therefore, be somewhat as represented below.



The same principles might be followed if divisions or smaller bodies were substituted for army corps.

Salient positions which can be enveloped, like Sedan, will be more difficult to hold than ever, as the concentration of fire due to increased range has become easier to bring about, and its effects are greater.

Some development in the tactics of the defence may also be expected in the direction of *false positions*. That is to say, a false position may be taken up by a certain proportion of the army—the ground being suitable—while the main position is within effective range of it in

rear. The object of the front position would be to cause the attacker to make his dispositions for and commit himself to attacking it as though it were the real line of defence, and the aim of the defender would be to retire from it after sufficient resistance, so as to cause the attacking troops, both frontal and outflanking, to become massed together in fancied success and considerable confusion within effective range of the main defensive line. The defender would then be in a position to make the most of this state of things, and probably take the offensive in his turn. Such were the tactics of Baker Pasha at Tashkessen, and they succeeded to perfection, though his inferiority of force prevented his resuming the offensive.

Retreats and Pursuits.—The defeated army, if driven off the field before nightfall, will probably, owing to the far-reaching effect of modern fire, be routed, and its only chance of safety will be under cover of the darkness, provided its resistance be stubborn enough to cause it to use up all reserves. In close country, however, a few determined men could stop the pursuit for a time by holding roads in positions whence they cannot well be ousted by artillery fire. In open country, their flanks being exposed, much more organized resistance than this will be necessary to check the pursuit, and comparatively fresh troops must be available to act as an efficient rearguard. The present decentralized fighting formation of troops does not admit of men, once beaten, being rallied to the same extent as was formerly the case, more especially as units are now so liable to become mixed.

Night Operations.—The necessity for making preparations for attack unknown to an enemy will often cause these preparations to be carried out by means of night marches, so that all may be ready for the onslaught at dawn. Attacks on a large scale made during the night, in order to gain immunity from the enemy's fire, are scarcely likely to be attempted, as the confusion caused among the attackers themselves would be such as no staff arrangements could prevent, and at night men are very liable to panic. Night attacks may, however, be made on favourable ground and against a careless enemy by small bodies when no combination marches are necessary, but *light* nights must be chosen both for this and for night marches, for it is then much easier to see friends and thus avoid confusion, while at the same time the foe is out of range of vision. Nights when clouds obscure the moon would probably be best, for there will be no reflection from glittering arms, and at the same time it will be dark enough to prevent an enemy seeing over the sights of his gun or rifle. Those who have done any night shooting well know how impossible it is to hit any large object, even twenty yards away, without white paper or luminous paint on the foresight. Open ground, over which it would be impossible to advance in face of an enemy by day, may be occupied by night and trenches dug to secure it, much after the fashion of opening the first parallel at a siege.

Influence of Ground.—It is probable that the nature of the terrain will have a largely increased influence in the future. Steep slopes, so long as they are not steep enough to form a serious obstacle to the

attack, will probably be a source of weakness to the defence, more especially if the attackers have good artillery positions within effective range. The crest defines exactly the line of defence, and such slopes afford the best opportunities for developing the covering fire of the assailant.

Broken ground in front of a position will be more a source of weakness than ever, for improved methods of fire discipline and control, and increased training of men for working over such ground will enable the attacker to make more and better use of it than formerly, when men untrained in such warfare soon became a disorganized mass.

Folds of the ground and woods, &c., are to be sought after by both sides and by all arms, to hide supports, reserves, artillery-wagons, and limbers, and bodies of cavalry, all of which have no longer any smoke to hide them from view. Such undulations not only give shelter from fire as before, but at close ranges the trajectory of modern weapons is so flat that the ground is actually less thoroughly searched than in the past.

Village fighting is not likely to be affected in any appreciable degree by the improvement in rifles.

The correct use of ground is therefore a most important part of the soldier's training. Just as, at Jena, the Prussians, trained after the method of Frederick the Great to fight only in the open, were beaten by the French, accustomed to adapt themselves to any ground, so in the future, the troops who can make the best use of the ground will have gone a long way towards securing the victory.

Thus, conditions of terrain will have an augmented effect on the battle of the future, and while a strong position will be more difficult, a weak one may become more easy to take.

Rear-Guards and Advance-Guards.—It has been seen that the difficulty of determining the strength and position of an enemy is now greater than formerly, and this ought to make rear-guard actions more easy to carry out. The enemy, unable to discover the strength and position of the rear-guard, will be more cautious, and he will know that ambushes for the rash are more easy to bring about. On the other hand, an advance-guard taking the offensive may frequently get involved in more serious fights than were bargained for. The risk, however, must be run up to a certain point and must be treated in the light of a reconnaissance in force in relation to the main army. This duty, however, does not necessitate advance-guards consisting of one-third of the whole force as in 1870. Such can only commit the army to premature battle. "If an advance-guard is large enough to gain time to the marching body to form up on suitable ground before attacked, it possesses all the strength necessary."[1] The distance between the advance-guard and the head of the main body seems likely to increase rather than diminish, since, on meeting an enemy, more time is given to the Commander to concentrate the troops of the main body in any desired direction before arriving on the battle-field.

[1] Article on "War," "Encyclopædia Britannica."

Retaining Forces.—Perhaps one of the most striking features in tactics with modern firearms is the increased power of resistance given to inferior numbers when opposed to large forces. Baker could never have held the heights of Tashkessen with 2,700 men against 30,000 in the old muzzle-loading days. Breech-loaders gave him the power to do so, and the latest improvements in weapons will still further increase this power. This would appear to make alternate blows at divided forces, after the fashion of the great Napoleon, still more possible in the future than in the past, the retaining force now having in a still greater degree the power to carry out its functions. On the other hand, however, the same argument tells us that the beating of the enemy's other army by the main forces may take a longer time. The truth, therefore, appears to be that where a retaining force is necessary, the one counteracts the other, and places the conditions much as they were. But where distance alone is relied on to prevent the two allied armies from combining, that distance will now have to be greater in order to give time to the concentrated opponent to carry out his object.

Crossing Rivers.—Owing to the longer range and concentrative power of modern weapons, this operation may be carried out under more favourable conditions than formerly. The ground being favourable, the whole neighbourhood of the intended crossing can be swept by fire till the landing is effected. The same holds good for a landing on a hostile shore of the sea. On the other hand, however, the defender by retiring out of range of the ships or forces on the opposite shore of a broad river, can bring a wider and more effective circle of fire to bear on the first party which lands. The tendency, therefore, appears to be towards crossings and landings being carried out over a wider front than formerly.

Marches.—On account of the difficulty and loss of time attending the movement of large forces to a flank when near the battle-field, endeavours will be made to arrange all marches so that the army may be in the most favourable position for carrying out modern tactics on the battlefield with the smallest amount of alteration of plans. Envelopment being now most sought for, and most to be guarded against, the tendency on both sides will be to make the flank marching columns at least as strong and probably stronger than those in the centre, and thus allow the normal battle order to be formed with the least amount of friction. Thus an army of five army corps or five divisions marching by three roads might place two on each of the flank roads and one in the centre. Two army corps of three divisions each, marching by four roads, might have two divisions on each flank road, and one on each of the centre roads with the corps artillery. In 1870 this system was not carried out by the Germans, and the tendency was to make the centre column the stronger on the march as in battle.

The same reasoning tells us that "supporting distance" between columns has become a more elastic term, and columns may march further apart, where roads suit, than in the past. Thus the front of an army will be more extended, and the amount of country overrun

and available for requisitions will be greater. This means increased work for the cavalry screen, and therefore it is, to say the least, premature to think of reducing the proportion of that arm.

Conclusion.—For such operations as are sketched above, a high standard of training is still more desirable than formerly, and, except for passive defence, armies cannot be raised to the required standard by a few months' drill. Reserves soon forget their training and lose their marching power, thus swamping the efficiency of those still serving with the colours when war breaks out. Yet reserves are a necessity, and those soldiers whose period of service with the colours is longest are (other things being equal) least likely to become inefficient.

Officers of all ranks have more responsibility thrust on them, and have to think and act by themselves for the general good more than ever. Staff Officers, in particular, require to be more highly trained in their work in order to make it possible to carry out such delicate operations as night marches and the various combinations above foreshadowed. All this leads us to imagine that the smaller highly-trained force will be able to beat those larger masses of men whose training and discipline have become rusty, in the future as in the past.

Discipline is more than ever essential where so much freedom is given to individuals, but this discipline must suit the character of the nation. Thus, the blindly obedient Russian soldier and the stolid German must evidently require discipline of a different sort to the more independent-minded Anglo-Saxon.

Decentralization must be the watchword in fire discipline, ammunition supply, and staff arrangements. The whole organization and tactics of an army depend for success on the highest training it is possible to give to human beings, and the army to which it is given wields indeed an enormous power. Like a modern racehorse, however, whose powers require the constant care of the trainer to keep them in a state of development, an army will lose half its might unless cared for and directed in its work by the highly-trained General and his subordinates. The difference between the trained army and the mob is now, perhaps, wider than ever, and every improvement in weapons requires more and more training to develop the new power placed in men's hands.

Ammunition Supply and Transport.

Supply of Infantry Ammunition.

Necessity for Ample Supply.—It is not necessary to enlarge on the absolute necessity for an ample supply of ammunition being ensured to the soldier on the battlefield. That is sufficiently obvious to all. Only second to it in importance is the question of replenishing that supply after the battle is over. Bazaine states that it was owing to the deficiency of the French in the latter respect that he did not

renew his attack on the exhausted Germans at Mars-la-Tour on August 17th, 1870. Even by the 18th, the French 6th Corps had not, according to French accounts, refilled their pouches since the battle two days previous.[1] Should these allegations be true, and we have no reason to doubt them, a great part of the responsibility for the disasters which befell the French rests on this failure of their ammunition supply system. Thus the question resolves itself into two headings:—

(1.) Supply for a battle.
(2.) Additional supply available for the following day.

Dealing with these in turn, let us consider what number of rounds is necessary for the infantry soldier in action.

Expenditure in late Wars.—Examining the question by the light of previous experience of the results of improvements in firearms, we find that, in 1866, the Austrian expenditure was sixty-four rounds per rifle in Bohemia. This was with muzzle-loaders.

The expenditure of the Prussians in the same campaign with the breech-loader was only seven rounds per rifle.[1] This is a remarkable fact, even though it be discounted by the large amount of ammunition probably thrown away during the Austrian retreats. Yet it is evident, if there be any truth in these figures, that the possession of a rapid-firing weapon by the Prussians did not increase the ammunition expenditure on the *average of the campaign*. Therefore, *any large increase of the stores of ammunition at the base and parks far in rear of the army seems unnecessary.*

Expenditure on the Battlefield. — But we cannot found any arguments for settling the amount to be available per soldier on the battlefield on the *average* expenditure, either in a campaign or in a battle. The only guide which can be made use of is the maximum amount expended by small bodies on the battlefield. It is stated that at Skalitz and Tratenau[2] some of the Prussian companies expended 80 to 100 rounds per man. At St. Privat the French fired away all their ammunition, nominally ninety rounds per man, but, as previously remarked, the corps holding that part of the position had not full pouches. Perhaps the greatest expenditure which has ever taken place with breech-loaders was at Tashkessen, where Baker[3] states that many of the Turkish battalions fired away nearly 300 rounds per man. Yet even this high figure is stated to have been exceeded in the fighting in Spotsylvania by the Americans with muzzle-loaders, for it is related that on one occasion as many as 300 to 400 rounds per man were fired.[4] It will be observed that in both these last two instances this remarkable expenditure was incurred strictly on the defensive. The greatest amount per man expended on the offensive was perhaps in the action at Champigny during the siege of Paris, where the French[5] had 108

[1] "Mayne's Fire Tactics," p. 281. [2] *Ibid.*
[3] "War in Bulgaria," vol. ii, p. 160.
[4] "Battles and Leaders of the Civil War," vol. iv, p. 174.
[5] Mayne, p. 281.

rounds per man, and eventually had to retire from want of ammunition. The greatest expenditure by the Russians in 1877–78 in one day is stated at ninety-four rounds per man, and this may be taken as on the offensive.

Greater on Defensive than on Offensive.—It will be seen, therefore, that the expenditure on the defensive is generally greater than on the offensive. The reason for this is simply that the defenders begin firing at longer ranges, and that a good part of the attackers' time is taken up in advancing. The tendency was also emphasized in the case of the French and the Turks by their being armed with longer-ranging weapons than their opponents, though at Tashkessen the Russians were equally well armed.

Increased by want of Fire Discipline and Artillery Preparation.—It must also be pointed out that, in many cases, on the defensive there was little pretence of fire discipline, and in the attack—as at Champigny—the advance was conducted with little or no artillery preparation. Under these circumstances, it is evident that the absence of a good system of fire discipline and of adequate artillery preparation causes a largely increased expenditure of ammunition. The obvious deduction is that the better the troops are trained in fire discipline, and the more correct the tactics of the General, the less will be the number of rounds fired, and, consequently, the smaller need be the number carried. The extra power of a rapid-firing weapon is due much more to the amount of projectiles it has the power of throwing *in a short space of time* than to the number it *actually* fires off. The reasons for this will be found discussed under the heading of Quick-firing Guns.

Experiments.—Turning to the field of experiments as a guide—but one on which we must beware of placing too much faith—it was found that at Cassel, in 1878, the XIth German Army Corps, trained in the new principles of fire tactics, including long-range fire, expended an average of 100 to 120 rounds per man in three or four hours' manœvres, conducted naturally with much greater economy and coolness than would be the case in battle.[1] Captain Mayne adds one-half more as allowance for loss and increased consumption due to the excitement of battle, making 180 rounds per man necessary to be taken into the fight with *single loaders* in future. The Russians, on the other hand, consider 120 rounds sufficient. We prefer to take the mean and fix the number at 150 rounds per man with single loaders.

The Question with Magazine Rifles.—Turning to the same question with magazine rifles, it is stated, both by Colonel Slade[2] and Captain Mayne, that it has been proved by experiment "that the continuous fire of magazine rifles is only more rapid than that of ordinary breech-loaders while any cartridges remain in the magazine, and that there is no general gain in rapidity of fire in filling it again as soon as empty." This statement may now have to be modified if other nations follow the example of the Austrians, and load entirely through the magazine; and Captain Mayne justly points out that an

[1] Mayne, p. 282.
[2] "R.U.S.I. Journal," "Modern Military Rifles and Fire Tactics," vol. xxxii.

intermittent fire, such as is to be expected in battle, in which the magazine is used and refilled during the pauses, the expenditure will be much greater than with single loaders. No limit can now be put on the number of rounds able to be fired through fatigue resulting to the firer;[1] for the present small-bores have far less recoil than the rifles out of which the Turks fired nearly 300 rounds per man at Tashkessen. It is therefore to be expected that—with small bodies more particularly—the number of rounds fired may run up to even 500 or 600 per man on the defensive, *when there is bad fire discipline.* An efficient system of fire discipline will, however, change the aspect of the question. By fire discipline all long-range fire will be kept strictly under control, and ammunition will not be wasted in independent firing at immense ranges as was done at Plevna and at Gravelotte. But as the combat gets hotter and closer ranges are reached, as Officers and non-commissioned officers fall, so the strain on men's nerves becomes greater, and may soon cause them to disregard the words or signals of the few remaining leaders. Finally, uncontrolled magazine fire may become the order of the day on one or both sides. Before long one side or the other will give way and retreat under a hail of bullets. By undisciplined troops this stage would probably never be reached, for all their energies and all their ammunition would have been expended in long-range firing, as indeed happened many times during the latter part of the Franco-German War.

Number of Rounds Necessary per Rifle with Trained Troops in Battle. On the Offensive.—All things considered, and allowing for possible insufficient artillery preparation, it is considered that troops well trained in fire discipline should enter into an attack with 200 rounds per man actually on the soldier's person, or 50 more than with single loaders. There should also be additional rounds available for conveyance to him when chances occur during the fight. In fixing the above large number it must be borne in mind that the soldier's courage evaporates in the same proportion as his ammunition, and that it is extremely problematical whether reserve ammunition can be conveyed to him during the combat.

On the Defensive.—The figures of ammunition expenditure for the defence are usually so much greater than for the attack that we would wish to ensure 300 rounds per man to a force holding a position. This figure has also the approval of Colonel Slade,[2] and ought more easily to be supplied for the defence than the 200 for the attack, for in the former case ammunition columns can come up more easily, and boxes of ammunition can be placed at intervals along the line.

Number Necessary to Refill Pouches and Carts.—In addition to the above amount, there must be ample means of filling up empty pouches at the end of the day, so that in the future a General may not be prevented, like Marshal Bazaine, from renewing a drawn battle under more favourable circumstances the following morning. As, however, it is unlikely that the *average* expenditure per man in an Army

[1] "R.U.S.I. Journal," "Modern Military Rifles and Fire Tactics," vol. xxxii.

Corps would exceed 150 rounds in a day's hard battle, it ought to be sufficient if the Divisional and Army Corps columns carry that number between them, thus making a total of 350 rounds per man with the army in the field.

Scale recently adopted in Foreign Armies.—Table A shows the views of foreign nations on this important subject, and it will be seen that the most recent change—that of Germany—is in the direction of providing the soldier with a largely increased supply on his person, so as to render him more independent of reserve ammunition. On the other hand, France, while carrying fewer rounds available at once for battle, has a large reserve with the ammunition columns ready to refill pouches at the end of the day. The tendency, however, to increase the ammunition supply does not yet appear exhausted, and the above cannot be regarded as final. Every decrease of weight brought about by smokeless powder, the substitution of aluminium for brass in the cartridge case, or other change of matériel will be made use of to increase the number of rounds carried.

This question of weight prevents our loading the soldier with the whole 200 rounds we have fixed on as necessary for a battle. Mobility being, next to fighting efficiency, the most important essential to an army, it is desirable to keep down the weight on men's backs as much as possible. The proportion of weight of the M.H. cartridge to that of our new weapon is as 70 to 115. Thus the soldier can now carry 115 rounds without increase of weight. It is desirable to augment this to 120, and economize weight in some other portion of his kit. Thus the clothes brush might be dispensed with, and the water bottle lightened by being made of vulcanite; even the cape might be left with the baggage in temperate climates, and every effort made to lighten the soldier's packs.

Method of Carrying the Ammunition on the Soldier.—As to the way in which this ammunition should be distributed on the person of the soldier, the methods at present in use in the various armies may be studied with advantage.

France.—With the old rifle 78 rounds were carried, viz., 36 in pouches on the belt and 42 in the knapsack.

Austria.—Each soldier carries 100 rounds, viz., 60 equally divided between two pouches in front, and the remaining 40 in a larger pouch behind. This pouch has also a division for iron rations. The waterproof bread bag can also be used for ammunition. The three pouches are fixed on the waistbelt independent of the knapsack straps, so that the latter can be removed without depriving the soldier of his ammunition and reserve rations.[1]

Germany has copied the Austrian method, and carries 60 rounds in two pouches in front and 90 in a large pouch behind.[2]

Russia.—84 rounds on man—30 in pouches and 54 in knapsack.

England.—40 in pouches and 30 in valise (old equipment). The new equipment is not settled.

Of the above methods, the Austrian manifestly presents many

[1] Mayne, p. 292. [2] "Transfeldt," 1890.

TABLE A.

How carried.	Supply of Infantry Ammunition.						Remarks.
	France.	Germany.	Austria-Hungary.†	Russia.‡	England.‡	Proposed scale.	
By the soldier	112·0	150	100†	84‡	70‡	120	* These are the figures given with the old rifle by Captain Mayne, but probably they will be altered to suit the new one, just as the number carried by the soldier has been increased to 150. † Old magazine rifle. ‡ Single loaders. § 16 boxes of 1,100 rounds each per cart.
Battalion reserve in carts, &c.	26·5	38*	35	48	30	80§	
Total available at once	138·5	188	135	132	100	200	
In divisional or 1st échelon column	66·4	30*	48	52	40	50	
Total supply for battle.....	204·9	218	183	184	140	250	
In battalion baggage wagons	2·6	11*	—	—	10	18	
In A.C. or 1st-échelon column	46·5	30*	32	10	30	82	
Total supply by next morning	254·0	259	215†	194‡	180‡	350	

References, France.—"Regulations for the Supply of Ammunition in the Field," and "Aide-Mémoire de l'Officier d'État-Major," July 1st, 1890.
Germany.—"Transfeldt," 1890, and "Armed Strength of the German Empire."
Austria-Hungary.—Mayne's "Fire Tactics."
Russia.—"Armed Strength of Russia."

advantages. The extreme importance of a man being able to remove his valise without depriving himself of his ammunition and rations is sufficiently obvious, as also the advantage of being able to get at his reserve ammunition without removing his valise or screwing his hand behind his shoulders to get at it in an impossible position. By this method the Germans carry 150 rounds, so that the British should find no difficulty in carrying 120, leaving room at the same time for extra rounds to be given out before battle. As regards the weight on the belt, those who shoot with cartridge belts well know how little inconvenience is suffered from them when the belt is buckled very *loose*, so that the weight rests on the *hips* and not on the stomach. The reason is simply that the hips are the natural supporters of weight, and are close to the centre of gravity of the body; here the breathing is not interfered with, and the arms and shoulders are left perfectly free for using the rifle. What is required, then, is an equipment similar to that of the Austrians or Germans, and men must be encouraged to loosen their belts to the necessary extent whenever they march with full weights. A pair of large breast pockets should also be provided to contain extra rounds in case the haversack contained rations. The men should be trained to use the extra ammunition first, and to reserve that in their front pouches for close ranges, as being most easily got at. Spare magazines might be carried in their front pouches.

Distribution of Remaining Rounds.—The remaining 80 rounds of the 200 would be carried by the battalion carts and mules,[1] while of the extra 150 rounds per man, it seems desirable that 50 should be carried in the divisional ammunition column to fill up empty battalion carts during the fight, and the remaining 100 should be distributed between the battalion baggage wagons and the rear sections of the army corps ammunition column so as to be available when the battle is over. This proportion takes account of the difficulty of replenishing the supply during a fight, a difficulty which does not exist with artillery to a like degree.

Supply of Artillery Ammunition.

Rate of Firing Increased.—In settling the amount of ammunition necessary per gun, we are not handicapped by want of previous experience as in the case of magazine rifles. The gun is still a single loader, and likely to remain so, except possibly for horse artillery acting with cavalry. However, the use of brakes for checking recoil, the system of carrying shell ready fuzed and increased rapidity in setting the fuze, probably the introduction of metal cartridge cases, percussion locks, and traversing gear to enable the layer to dispense with the services of the man at the handspike, and certainly the introduction of smokeless powder—all these will increase the rate of fire to a considerable extent, while the increased amount of artillery preparation now necessary renders it probable that, for the assailants at least, a much

[1] Each cart carries 16 boxes of 1,100 each, and each mule 2 boxes. Total, 74,800 per battalion, or about 80 rounds per rifle.

larger expenditure of ammunition will take place in the future than in the past. When both sides intend being assailants; and the artillery duel is hotly contested, the expenditure will reach a very high figure. But against this must be set the fact that shrapnel fire is now more effective than of old. Flesh and blood can only stand a certain amount, and every shell being now more effective than formerly, and at the same time the rapidity of fire being increased, the decision of the artillery duel, *once the range is found*, must occupy a shorter time, provided neither side seeks artificial cover. Yet firing will commence at longer ranges, and much preliminary ammunition expenditure will take place where the ground permits of such ranges.

Past Experience.—If we look for guidance to the experience of past wars we find that the expenditure of the fifteen batteries of the Prussian Guard at St. Privat was at an average of 100 rounds per gun,[1] and the fight was not begun in this part of the field till about 2 P.M. In a battle commencing much earlier in the day the expenditure might have reached 200 rounds per gun, especially if the hostile artillery had been able to make a better fight. At Mars-la-Tour, the great artillery battle, some batteries almost attained this amount. The 1st and 3rd horse artillery batteries of the IIIrd Army Corps fired 191 and 194 rounds per gun respectively,[2] and the *average* of the whole fifteen batteries of the corps was 130 per gun, and would have been much greater had ammunition been available. Hoffbauer says:[3] "The deficiency of ammunition experienced in the afternoon, more particularly on the right of the position, ... had its influence in checking the detaching of batteries (to other parts of the line where wanted). The slowness of their fire and the actual silence of some of them encouraged the enemy to make more frequent and vigorous attacks." Then he states that the German attacks from the Bois de St. Arnaud received no direct support from artillery, and were consequently unsuccessful. Later on, he continues: "the account of this battle teaches that, owing to great expenditure of ammunition, the first line of wagons of the ammunition columns should follow the troops as closely as possible . . . . and that the number of artillery ammunition columns should, as a rule, be increased in that (the first) line." Prince Kraft tells us that this was done after Gravelotte, and half the infantry first line columns were turned into artillery columns. It may be remarked that this could not so easily have been done had their infantry columns consisted of our S.A.A. carts. The same high authority says he is "convinced that the quantity of ammunition which we carry, whether with the batteries or with the columns, is not sufficient. You cannot safely reckon, especially in the case of decisive battles where such great masses of troops are collected to take part in the decision, upon the columns being able to make their way through the combatant troops during the very day of battle. We must, therefore, fill up the limbers and wagons of the

[1] Prince Kraft, "9th Letter on Artillery."
[2] Hoffbauer.
[3] Hoffbauer, "The German Artillery," translated by Captain Hollist, p. 135. Prince Kraft, "9th Letter on Artillery."

batteries with as much ammunition as they can possibly consume during the whole length of a day of battle." He then goes on to show how if the battle of St. Privat had commenced in the morning and not in the afternoon, the batteries must have fallen short, owing to the divisional columns having been used to fill up the empty boxes of the IIIrd and Xth Corps engaged two days before, leaving the Guards' batteries dependent on the army corps columns in rear. After the 18th August all the columns were exhausted, and they had first to go to the park at Herny to the east of Metz, round by Pont-à-Mousson, only to find even that depôt exhausted. Then they proceeded by forced marches to Saarlouis on the frontier, where they filled up, and only just arrived at Sedan in time for the battle, a fortnight after Gravelotte. It is evident that a similar risk ought not to be run in future. Ammunition columns and parks must carry sufficient to prevent their being entirely emptied by two such days of battle. For though there were two days of hard fighting, yet the guns which fought on the 16th took comparatively little part in the expenditure of the 18th.[1] Therefore the total expenditure was not much more than might have been incurred in one long day of battle. At Solferino it is stated that some guns fired as much as 300 rounds each.[2]

Number of Rounds arrived at as necessary in Future.—Taking all things into consideration it seems desirable that 250 rounds per gun should be available for the day's battle, *i.e.*, should be carried with the batteries and 1st echelon of columns, of which at least 150 should be with the batteries, for the columns may not get up till late, as Prince Kraft says, or not at all; also, that 100 rounds per gun additional should be available by the following morning, *i.e.*, with the rear sections of the army corps column; and that 50 to 100 rounds per gun be with the advanced park. Colonel Walford, R.A., in a lecture at Shoeburyness,[3] enters minutely into the question of the time by which it may be expected that the ammunition columns will arrive on the field, and calculates that in the case of an army corps marching by one road only, the various divisional columns will arrive on the scene in ample time for the renewal of ammunition, but that the 1st Section Corps Ammunition Column will not arrive till 1 hour 20 minutes after the shrapnel with the corps batteries may be expected to have become exhausted. But these calculations are made on the supposition that there will be no blocks on the road, that an action is expected and the ammunition columns are closed up to the tail of the combatants, and that each divisional column will immediately follow its own division on the line of march. It is extremely doubtful whether this order of march would be followed, and appears more likely that when the time came the divisional and 1st section corps column would march together in rear of the combatants of the army corps, as indeed is expressly laid down should be done in the French regulations. In this case it is calculated that the ammu-

[1] *Vide* Hoffbauer's Tables.
[2] "Revue du Cercle Militaire," 5th January, 1890, p. 3.
[3] "R.A.I. Journal," September, 1890.

nition columns would not reach the batteries till 5½ hours after the commencement of an action.[1] It seems to be more suitable that any extra ammunition transported with the combatants should actually belong to each battery or field artillery division. If all the ammunition columns marched together in rear, the supply with the batteries would evidently very soon run short, if on the present scale in our service of 108 rounds per gun. Therefore this number must be increased largely, and, though not coming within the scope of this paper, so long as common shell are mere range-finders, the percentage of them carried might be reduced, as suggested by Colonel Walford, to about 20 per cent. of the whole. But in order to be able to effectively destroy matériel it would be necessary to follow the example of the French and add a wagon full of melinite shells per battery.

It is a curious fact that with the old 9-pr. R.M.L., our batteries carried 148 rounds per gun, or with second line of wagons provided in India, 256 rounds per gun. Now that breechloaders have been introduced and firing has become more rapid all round, the number of rounds carried per battery has been largely *diminished*.

Comparison of English with Foreign Ammunition Transport.—Table B shows the measures foreign Powers have taken as compared with England, for providing for the expected extra expenditure of ammunition. An examination of this table will show that:

(1.) England has a much smaller supply of rounds per gun *with the battery* than any other Power, except in the case of the Russian 27½-pr.

(2.) The English battery has fewer ammunition wagons per battery.

(3.) England allows for a smaller *total* supply of ammunition in the field per gun than any other Power for guns of similar calibre, in spite of the rear sections of our army corps column carrying a larger proportion per gun than any other Power.

(4.) Though our horses are stronger and better, and though our gun carries a lighter shell than any other field battery gun, yet the number of rounds carried per wagon is considerably less than in the wagons of France and Germany, and the total weight of these rounds is, with the exception of the Russian horse artillery, much less than in the case of foreign Powers.

(5.) The weight of our ammunition wagon empty is much greater for the weight of ammunition carried in it than those of foreign Powers. Thus the German field battery wagon empty weighs 21½ cwt., and carries 1,617 lbs. of ammunition, while the English wagon empty weighs 23¾ cwt. and carries only 1,188 lbs.

Deductions.—Thus England is inferior in all questions of economy of power. *The weight of ammunition drawn by six English horses could actually be comfortably carried on six average pack animals.* It is perfectly evident that the construction of our wagons leads to an enormous waste of power; *weight*, not *strength* of construction, ap-

[1] "Revue du Cercle Militaire," 9th February, 1890.

TABLE B.—*Supply of Artillery Ammunition.*

Where carried.	France.		Germany.		Russia.			England.	Proposed scale.	Remarks.
	Field battery.	Horse battery.	Field battery.	Horse battery.	Light field.	Heavy field.	Horse battery.	H.A. and light field.	Light field.	
Rounds per gun with battery.....	141	156	135	153	150	108	130	108	156	* Allowing 15 batteries per army corps and cavalry brigade, the corps artillery being allotted the same number of rounds as the divisional batteries.
1st échelon ammunition column ..	62	87	57	67	135	108	135	74	95	
Total for battle	203	243	192	220	285	216	265	182	251	
2nd échelon ammunition column ...	54	61	57	67	43	30	43	77*	100	
Total in field	257	304	249	287	328	246	308	259	351	
No. of rounds per wagon	76	87	77	86	80	45	55	72	90	
Weight of each round	22 lbs.	16½ lbs.	21 lbs.	14 lbs.	18 lbs.	31½ lbs.	18 lbs.	16½ lbs.	16½ lbs.	
Approximate weight of ammunition carried per wagon drawn by 6 horses.....	1672 lbs.	1415 lbs.	1617 lbs.	1204 lbs.	1440 lbs.	1410 lbs	990 lbs.	1188 lbs.	1485 lbs.	
Weight of empty wagon	28 cwt.	21¾ cwt.	21¼ cwt.	21 cwt.	23¼ cwt.	23¼ cwt.	20 cwt.	23¾ cwt.	21¼ cwt.	
No. of ammunition wagons per battery	9	9	8	8	16 (8 guns)	16 (8 guns)	12 (6 guns)	6	8	
Weight of shell.....	17 lbs. 10 oz.	13 lbs.	17¼ lbs.	12¼ lbs.	15 lbs.	27¼ lbs.	15 lbs.	12½ lbs.	12½ lbs.	

References. *France.*—"Regulations for the Supply of Ammunition in the Field," "Aide Memoire de l'Officier d'Etat Major," and "Aide-Mémoire de Génie et d'Artillerie."
Germany.—"Armed Strength of the German Empire."
Russia.—"Armed Strength of Russia."
England.—"Manual for Field Service," Royal Artillery, 1889.

pears to be the ruling principle, and our Arsenal cannot be congratulated on the results achieved. There is no reason whatever why our light field artillery should not be provided with a wagon carrying at least ninety rounds of ammunition (13¼ cwt.) and weighing 38 cwt. packed, including 3½ cwt. for kits and equipment. If this were done we should be able to carry our 156 rounds per gun with eight ammunition wagons per battery, but with the present wagon ten of them per battery will be necessary to reach that amount. In short, as our artillery is at present constituted, nothing less than an addition of three wagons per battery will place its ammunition supply on at all a satisfactory footing. This will give 144 rounds per gun with the battery. With the horse artillery the case is similar, but the necessity for both lighter guns and wagons was sufficiently shown in the late cavalry manœuvres in Berkshire. As stated elsewhere, the question may probably be settled by the introduction of a 7- or 8-pr. quick-firing gun, or lower velocity 12-pr. for the batteries with the cavalry division. In the latter case a lighter wagon could surely be constructed to carry 72 rounds.

Composition of Ammunition Columns.

English and Foreign Ammunition Columns.—The principal foreign nations keep their infantry ammunition columns distinct from the artillery columns, and the Germans have the wagons of each of these columns painted a distinctive colour, those of the infantry being grey and the artillery blue. There does not appear to be any great advantage in this division, and all that seems necessary is that the infantry part should be easily detachable and easily distinguishable. The French form their artillery columns into two groups which usually march together, the first group consisting of twelve artillery ammunition wagons and two spare gun carriages, and always marching at the head of the column; the second group being the remaining wagons, corresponding to our ammunition and store wagons. The English divisional ammunition column consists of 6 artillery ammunition wagons, 11 ammunition and store wagons, 1 spare gun carriage and 34 S.A.A. carts, for which the only Officers allowed are 1 Major, 2 subalterns, and a quartermaster.

Proposed Divisional Ammunition Column.—To enable this column to transport ammunition on the scale proposed, viz., fifty rounds per infantry soldier, 95 per gun, and 8,000 per machine-gun, or a total of nearly 400,000 rounds of S.A.A., 1,710 artillery rounds, and 32,000 machine-gun rounds, we get—

398,400 rounds S.A.A. at 1,100 per box....		24 S.A.A. carts.
32,000 „ machine-gun ammunition ..		2 „
or a total of 26 instead of 34. This saving may be used to provide extra artillery wagons.		
810 artillery rounds at 90 per wagon.....		9 artillery ammunition wagons.
864 „ „	at 144 per ammunition and store wagon....	6 wagons.
36 „ „	in the spare gun carriage.....	1 carriage.
1,710 rounds.	Total carriages ..	42

For the proper management of this column of 42 carriages, exclusive of store wagons, there should be a complement of 1 Major in command, 1 Captain and 1 subaltern for the infantry portion, and 2 subalterns for the artillery portion, besides a quartermaster to assist the Major. With this organization the column will be capable of being split up without detriment.

Carriages.—With regard to the carriages, the S.A.A. cart leaves much to be desired. In its present form it can be used for nothing else except S.A.A., and the present cartridges are so strong that separate compartments for each box appear quite unnecessary. The balance changes with each box taken out, and cannot be adjusted. An open cart with a canvas cover as suggested by Captain Harris appears all that is desirable, and the weight saved could be used for extra ammunition or entrenching tools.

1st Section Corps Ammunition Column.—The 1st Section of the Corps Ammunition Column might also be made to carry 95 rounds per gun of the corps artillery, and the ammunition part would then consist of 15 artillery ammunition wagons, 4 spare gun carriages (2 appear sufficient), and 10 ammunition and store wagons, together with S.A.A. carts for the corps battalion and details. For this, a Major, 3 subalterns and a quartermaster might suffice. In all 1st echelon columns the artillery ammunition wagons should head the column on the march, followed by the S.A.A. carts.

2nd Echelon Columns.—The 2nd échelon columns do not require to be able to move so rapidly, and therefore instead of six horses per ammunition and store wagon, the same might be drawn by four animals of a heavier class, such as are to be seen in brewers' drays in England. They would seldom have to go off the road, and might therefore be driven from the box. By this means the length of the column would be considerably reduced without any loss of traction power. The wagons loaded with S.A.A. and weighing when packed 49 cwt. might even be brought up to the weight of those loaded with artillery ammunition, viz., 52¼ cwt., and their number reduced in proportion.

Instead of splitting up the 2nd échelon columns into three sections, it would seem better to have the same number of sections as exist in front, viz., four, each of which would be capable of being

detached with troops acting independently, and would carry a proportion of rounds corresponding to those in front. Thus the 2nd, 3rd, and 4th sections would be similar to divisional columns, while the 5th would act as 2nd echelon to the 1st section corps column, with a small section attached to it as 2nd échelon to the cavalry divisional column. The 2nd, 3rd, and 4th sections would thus each carry about 630,000 rounds of S.A.A. and 1,800 artillery rounds, and would consist of 17 ammunition and store wagons for S.A.A. (including one for machine-gun ammunition) and 12 ammunition and store wagons for artillery ammunition, with 1 or 2 spare gun-carriages. The 5th section would be constituted in a corresponding manner. As the corps artillery are, however, unlikely to fire away so many rounds as the divisional batteries, the number of rounds per gun in this section might be reduced to 60 or 70. For each of these a Major, two subalterns, and a quartermaster should be sufficient, as there would not be so much detaching of wagons as with the 1st échelon columns.

Having disposed of the question of the supply of ammunition necessary with an army in the field, and where it is recommended to be carried, the method of passing on this supply from rear to front on the day of battle will now be examined.

Replenishing Expended Ammunition.

In Captain Mayne's "Fire Tactics" will be found a précis of the regulations of most armies on this subject, so far as concerns infantry. Generally speaking, ammunition wagons have to follow troops in action as closely as possible, and privates trained as carriers distribute ammunition from the wagons to the fighting line. Therefore unless the wagons are brought close up and probably exposed, it seems impossible to distribute an adequate supply by this method.

Principles to be followed in arranging for Ammunition Supply.—Let us now examine into the principles it is necessary to follow in arranging for the replenishment of ammunition:

It is obvious that the nearer troops get to the enemy, the more hotly they become engaged, and the less under control; therefore, the greater becomes the difficulty of attending to such matters as refilling pouches, their whole attention being fixed on the enemy *in front*. Under these circumstances no complicated method of supplying them with ammunition, and no system dependent on a few privates for being carried out, will answer. Simplicity is the soul of warfare, and any such complicated system will fall to pieces under the stress of an enemy's fire. If picked men are chosen as carriers their example is lost to the firing line in front and their movements to the rear at a critical moment might be misinterpreted by their comrades. But the further to the rear we go the steadier the troops are found to be, and the more their attention can be directed to helping their comrades in front.

1*st Principle.*—Therefore it is evident that *any method of supplying ammunition under fire in order to be successful must be dependent on the troops in rear, and not on those in front.*

Again, the hotter the fight, the less desirable is it that ammunition should have to be distributed while it is going on, for it exposes the carriers and carts and wastes the time of those firing, many of whom will be too excited to notice the packets of ammunition thrust into their hands. In fact, *it seems impossible to distribute ammunition to infantry during the critical stages of the combat, i.e.*, within 700 yards of the enemy, and it is stated that the Austrians and Germans are recognizing this fact.

2nd Principle.—Therefore another principle deduced is that *the men must carry on their persons to the critical stages sufficient ammunition to ensure a successful ending to the attack.* From this it follows that the ammunition used during the early stages should be supplied as far as possible from the ammunition carts or wagons, so as to leave those carried on the person for the close attack alone. This principle is carried out in the various armies by distributing extra rounds before an action takes place.

Means of conveying Ammunition under Infantry Fire.—It seems a risky experiment to bring carts and wagons under infantry fire, in these days of smokeless powder, as is contemplated by most nations, for such large objects are bound to attract fire, where a single horse or mule would escape unobserved. The ground, too, may forbid the advance of a heavy vehicle, and it is a misapplication of a man's strength to make him a beast of burden. Therefore, the most suitable means of conveying ammunition into the firing line, when it can be done, appears to be pack animals. Each mule easily carries two boxes, each with 1,100 rounds (new rifle), weighing 171 lbs. in all. Therefore, our two mules per battalion carry 4,400 rounds, or about 15 rounds for each man of a firing line of 300 men. The advisability of doubling the number of mules per battalion may be considered.

Distribution of Extra Rounds before entry into Action.—As previously mentioned, we propose to distribute eighty rounds per man on entry into action, but this number need only be given to the firing line and supports, and a reduced number to the reserve companies, thus leaving the mules and perhaps one cart untouched. Or if working in brigade, the brigade reserve formed in our Service might supply the extra eighty rounds per man to the battalion or battalions which first advance to the attack, allowing their two carts and mules to accompany them intact, and ready to take advantage of pauses in the combat. On the defensive these extra rounds might be supplied from the ammunition columns, but on the offensive it is not likely they would be up in time. Naturally, the replenishment under fire might be helped by rounds carried by Officers and non-commissioned officers, and those taken from the dead and wounded by the "battle police." However, the great secret will be to start the men off with sufficient ammunition in the first place, and never to let the mules and carts be separated from their battalions on the march.

Replenishment of Artillery Ammunition under Fire.—The difficulty of supplying ammunition to artillery under fire is not nearly so great as with infantry, for the distance from the enemy is longer and the number of units of fire much smaller. However, the same principle

holds of working from the rear to the front, and leaving the commander of the battery to concentrate his energies on the shooting. As a general rule, the ammunition should be supplied from the wagons first, commencing at the wagon bodies, the limbers and teams being under cover and full wagons being sent up from the échelon in rear when required.

Systems at present laid down.—Table C gives, as shortly as possible, the system of supply in the artilleries of England, France, and Germany, when likely to remain long in one position. The methods pursued are evidently very similar in England and Germany, in spite of the severe condemnation by Prince Kraft[1] of so many échelons of wagons. In France, however, there are important points of difference. Unlike the former countries, France lays down that the empty wagons arriving from the guns shall remain with the "échelon de combat" till full ones arrive from the ammunition column, when their contents are transferred to the battery wagons. The French[2] also, by the order of December 28th, 1888, have dispensed with the intermediate échelon of wagons, and consider that it only complicates matters and renders supervision difficult, especially when batteries suddenly change position. The distance of 550 yards in rear of the guns has not to be exceeded, and is thought to give sufficient immunity from fire. The English battery has evidently an advantage in possessing a Captain to look after the wagons and regulate the supply. All three countries lay down, however, that the commander of the battery or group has to send for ammunition when required, instead of leaving the regulation of the supply to those in rear, though the French regulations encourage initiative in this direction on the part of the sergeant-major in charge of the wagons. The Italian regulations differ from the above, and lay down that the battery wagons, when empty, are to proceed at once to the 2nd échelon of the *ammunition columns*, their places at the batteries being supplied from the 1st échelon column by requisition from the battery, thus involving a change of carriages.

The chief point worth noticing about the Russian system is that the carriages are fitted with interchangeable trays, each containing three heavy or five light shell, while a similar number of cartridges are also packed in interchangeable cartouches. Thus a small supply can be left with the gun while the carriages are under cover, and packing empty carriages is facilitated.

New French Idea.—It is said that the French propose to do away with the 1st line battery ammunition wagons altogether, and to substitute two limbers for each wagon, with forty rounds each, drawn by two horses and interchangeable with the gun limbers. When the gun limber is empty, it is to proceed at once to the nearest wagons of the ammunition column to be refilled, and its place taken up at the gun by another limber from the rear. Thus the lead and centre horses are permanently under cover. The wagons of the ammunition

[1] "9th Letter on Artillery," "R.A.I. Edition," p. 94.
[2] "Revue du 1er de Militaire," 2nd February, 1890.

TABLE C.—*System of Artillery Ammunition Supply of a Battery in Battle when likely to remain long in one Position.*

	ENGLAND.		FRANCE.		GERMANY.	
	Echelons.	Remarks.	Echelons.	Remarks.	Echelons.	Remarks.
Fighting line.	Guns. 2 wagons.	Wagons unhooked.	Guns, Limbers, 3 wagons.	Limbers move under cover when long in action, and guns are supplied from wagons, which return to "échelon de combat" when empty.	Guns, 3 wagons (unhooked).	When these wagons are empty they return to 2nd line, whence they are *sent to the ammunition column* to be refilled by detachments.
First line of supply.	Gun limbers and 2 wagons (under cover) in rear of flank under Captain, about 100 yards from guns in open country.	Empty wagons from the guns are sent *direct to the ammunition column* to refill, and their places supplied at the guns by this 1st line.	No corresponding 1st line.		Gun limbers and 3 wagons, 230 yards from guns.	These wagons take the place of those with the guns when the latter are emptied, and 2nd line wagons then move to 1st line. *All this done by order of the battery commander.*
Second line of supply.	2 wagons under Q.M.S., about 900 yards from 1st line in open country.	Massed under an officer when three batteries are working together. When 1st line moves to guns, 2nd line moves up to 1st line.	*Échelon de combat.* 6 wagons under sergeant-major, 550 yards from guns in open country.	3 wagons move to guns when sent for. Empties from guns *remain with this échelon.* S.M. sends to ammunition column for full wagons when empties arrive, and *contents are transferred here.* "Echelons de combat" are massed under an Officer in groups of batteries.	2 wagons, forge, &c., 620 yards from 1st line.	These are grouped together under an officer (when near an enemy) by abtheilungs. On emergency, wagons can be sent direct to guns from the ammunition column.
Third line of supply.	Divisional ammunition column *or 1st sec. A.C.* col., 1,000 yards from 2nd line.		Divisional or 1st échelon ammunition column, about 1 mile from guns.	Divisional column halts 3 miles in rear for orders, and if battle proceeds favourably, it is brought up to within a mile of the batteries.	Divisional or 1st échelon column.	

References. *England.*—"Field Artillery Drill," Vol. II (1889).
France.—"Revue du Cercle Militaire," 2nd February, 1890.
Germany.—"German Field Artillery Exercises," 1889.

N.B.—The distances from the front are not to be exceeded, and usually depend on the cover afforded by the ground.

Information given elsewhere regarding Italian and Russian systems is taken from "*Istruzione per l'ammaestramento tattico dell' Artiglieria,*" and from the Russian "Field Artillery Drill Book."

column are to be packed with interchangeable limber boxes, so that a limber can at once be supplied with fresh boxes full.

There is a simplicity about this method which is very taking, but the weight of the limber boxes to be lifted on every empty limber is an objection. Probably the Russian system of packing is preferable, for it can be done by one man. It is doubtful, also, whether two-wheeled vehicles are as good over rough ground as ammunition wagons, but certainly limbers such as the above are vastly preferable to the heavy ammunition carts tried at Okehampton in 1889. The latter carried sixty rounds and required four horses to drag them, thus no saving of animals or men was effected, and the weight on the two wheels was far too much for soft ground.

Transmission of Orders.—The chief difficulty in keeping the machinery of ammunition supply in working order lies in securing the rapid and correct transmission of orders to the échelons in rear, and in the latter finding out what they may be required to do. In connection with this it is interesting to study the latest regulations worked out by the French on the subject.[1] All connection is established from rear to front by means of "agents de liaison" or representatives from each échelon in rear, which are attached temporarily to the échelon next in front. Thus, each 1st échelon ammunition column sends a non-commissioned officer to follow the commander of the group of batteries to which it is affiliated, and two (in case a battery were detached) to the Officer in charge of the "échelon de combat" of the group, while the latter, in turn, has a similar representative with each battery or group commander. Even the limbers, when under cover, have an "agent de liaison" with the commander of the battery. When any orders or communications have to be sent to the bodies in rear, these "agents" convey them, each to his own échelon, and return to their stations immediately the orders are executed. Each will also remind the commander to whom he is attached of anything forgotten in regard to his échelon, and will keep himself informed of everything pertaining to it. By this means it is hoped that communications may be kept up without the slightest hesitation, and certainly there seems good reason for the belief.

Proposed System.—By combining the good points of the above systems with the principle of working from the rear to the front, we arrive at the following system:—

Every carriage with the batteries and 1st échelon ammunition columns should be packed with interchangeable trays of ammunition, each tray containing three or four rounds complete. This could easily be done if brass cartridge cases were introduced. The "agents de liaison" system should be established throughout. The wagons of the battery or group (except those with the guns) should be all kept together under a Captain, not more than 600 yards from the guns in action, and that Officer should regulate the supply of ammunition to the batteries in concert with his "agents," with whom he could

[1] "Revue du Cercle Militaire," Feb. 2nd, 9th, and 16th, 1890.

communicate by an orderly. He would thus be kept informed of the exact state of the ammunition expenditure, and could replace empties without troubling the commanders of batteries. He would also get due warning, through his "agent" with the group commander, of any contemplated change of position. Wagons, when nearly empty, would place their remaining full trays on the ground, and proceed to the Captain in rear. Meanwhile, the latter Officer will have sent the A.C. "agent" to his ammunition column, and on arrival of full wagons their contents will be rapidly transferred to the empties by means of the trays. Should time press the teams might be exchanged, for it is of far greater importance to keep the same horses and men with a battery than the same wagons, and the time taken to change teams and take off a few gunners' kits would be very short compared with repacking, if every shell and cartridge has to be separately transferred. In case of emergency, the wagons of the column might go direct to the guns, but as the horses will be untrained to stand fire and the drivers inferior, it is advisable to avoid this when possible.

The 2nd line of wagons of each group of batteries might be massed together on the march when near the enemy, and follow in rear of the body of troops to which they belong.

Movements of Ammunition Columns.—With regard to the proceedings of the ammunition columns, the same principle of working from the rear should be followed out. The commander of the column must do his best to anticipate the wishes and wants of those engaged in the all-absorbing combat. News of battle travels fast, and may probably reach him before either of his "agents" arrive from the front. In spite of every care it will frequently happen that he receives no orders, and will have to act on his own initiative. This he must be encouraged to do, and must press on to the front. In default of orders he should halt the main part of his column just off the road, when he judges himself to be within 2 or 3 miles of the guns, and send off two sections immediately, each under an Officer, one to the artillery, consisting of the nine artillery ammunition wagons (in the case of divisional columns), and the other of about eight S.A.A. carts, to find their respective arms in action. These vehicles, like all ammunition wagons or carts, should be painted a distinctive colour, or be provided with distinguishing flags, so as to catch the eye of the "agents," or others hunting for them. The ammunition column commander and his subordinates are much more likely to be successful in finding the position of their division in the fighting line than are a few empty carts or wagons from the front to succeed in discovering the whereabouts of their ammunition column. The sounds of the firing, and the wounded men and stretcher bearers passing to the rear, will be never-failing guides to the Officers of the ammunition columns on nearing the field of battle. Prince Kraft[1] relates how the 2nd échelon ammunition column at Thiancourt, on the 18th August, 1870, marched to the sound of the guns and came in time to supply the place of the emptied 1st échelon. Such action should be the rule, and not the exception. Even should the empty

[1] "9th Letter on Artillery."

carts and wagons from the front find the column and get refilled, they might have considerable difficulty in reaching their respective units again, unless commanded by an Officer. "When a regiment of infantry or cavalry encounters a few wagons commanded by an unhappy non-commissioned officer, will it let them pass? No, it will take them for a part of the train. . . . and will drive them into the ditch."[1] On arrival of the sections at the front, the "agents," or those in charge of the brigade S.A.A. reserve or groups of battery wagons would soon see them as they passed along the rear of the line. The carts or wagons could be exchanged, or have their contents transferred according to the emergency of the case. Should no extra ammunition be required, the sections of the ammunition column could remain as a reserve till wanted. Their non-return would be taken by the commander of the column as a sign that no more were required. Should they return with empties, they could refill and again start for the front if it was seen that a fresh supply was likely to be required. Once connection is established in this way the rest is easy, and the ammunition columns could advance to any desired spot and their whereabouts be made known to all concerned. In the same way the 2nd échelon ammunition columns would draw near to the front as soon as news of battle came, either through their "agents" with the 1st échelon columns, or otherwise, and sections of them might be sent up to the columns in front to refill them if desired.

Paper Work.—All red-tape in the way of written requisitions and receipts must be done away with in stress of battle. With regard to this Prince Kraft remarks,[2] "When a man is readily venturing his life from moment to moment at the call of honour and duty, he thinks it hard to be required to render an account of expenditure when perhaps he may, within the next half hour, make settlement in full with his life's blood, and even if a corps should render a false return to the amount of 10,000 rounds, it could be done without detection merely by showing 10,000 extra cartridges expended. But who would ever dream of embezzling cartridges in time of war? . . . . Therefore you must, when in the field, give up controlling your expenditure of ammunition by double entry." He then goes on to explain that he was taught by experience that the demand for periodical ammunition returns only delayed the issue without being any real check on the consumption. The only real check possible or necessary, in our opinion, is for the A.C. column to tick off the number of wagon-loads delivered to the divisional columns. As this would represent the actual expenditure in refilling pouches and carts, it would really be the expenditure on the battlefield by the various divisions. Closer than this it seems unnecessary to go. As bearing on this, it may be mentioned that, after the Suakim Expedition in 1885, nearly all the ordnance store accounts had to be wiped off as hopeless.

[1] "Revue du Cercle Militaire," 2nd February, 1890, p. 91; also Prince Kraft's "9th Letter on Artillery."

[2] "R.U.S.I. Journal," vol. xxix, p. 785.

Advantages claimed for the System.—By the system explained above it is claimed that—

(1.) The work is more equalized on the field of battle, those in rear having their active duties as well as those in front.

(2.) The attention and duties of every combatant are concentrated on his *front*, and no combatant soldiers leave their regiments for the rear unless wounded. This ought to be a gain to *morale*.

(3.) There is greater rapidity in the supply of reserve ammunition, and that supply is more certain.

(4.) Empty carts and wagons returning to the rear *after* having delivered a fresh supply of ammunition to the combatants can do so more leisurely if they know the supply is ample for some time, and they can, in such a case, be made use of to convey wounded to the field hospitals, which will naturally be established near the ammunition column.

Conclusion.—We cannot do better than conclude by quoting Prince Kraft's summing up of the question of ammunition supply in the future:[1] "It will be doubtless necessary for ammunition columns to detach wagons to different parts of the fighting line, and we must make up our minds to this. Troops actually engaged must make a point of completing their ammunition at all times without waiting for orders whenever they get a chance of doing so, whilst the leaders of ammunition columns following out of fire must consider it a sacred duty to meet the troops to which they are attached half way, and to furnish them with supplies, and also *without awaiting orders*, which the General might neither have the time nor the means to send in the heat of battle."

Ammunition supply, under the present regulations, shows too much centralization to work well in battle. In this, as in other matters, *decentralization* must be the ruling principle, and only by making the personnel of ammunition columns responsible for the timely supply of ammunition to troops in action, and for always keeping full up the wagons of those in front, can this principle be carried out in its entirety.

[1] "R.U.S.I. Journal," vol. xxix, p. 786.